Health Leadership and Quality of Life. 2025; 4:608
doi: 10.56294/hl2025608

ORIGINAL

Reviewing the Evidence on Diet and Risk Reduction for Cancer Prevention Through Lifestyle Changes

Revisión de la evidencia sobre la dieta y la reducción del riesgo para la prevención del cáncer mediante cambios en el estilo de vida

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Cite as: S A, Hansraj Patadiya H, Verma A, Parmar Y, Shukla P, Ahmad Qurishi A. Reviewing the Evidence on Diet and Risk Reduction for Cancer Prevention Through Lifestyle Changes. Health Leadership and Quality of Life. 2025; 4:608. https://doi.org/10.56294/hl2025608

Submitted: 28-05-2024 **Revised:** 22-10-2024 **Accepted:** 21-05-2025 **Published:** 22-05-2025

Editor: PhD. Prof. Neela Satheesh

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ABSTRACT

Cancer is still one of the main reasons of death in the world, which has led to a lot of study into ways to keep people from getting it. Changes in living, especially changes in food, have been linked to a lower chance of getting cancer and are seen as one of the most hopeful treatments. This study looks at the latest research on how food affects the risk of cancer and how to avoid it. It focuses on how certain nutrients, eating habits, and general living can lower the risk of cancer. Several studies have shown that eating a lot of fruits, veggies, whole grains, and fiber can lower the chance of many types of cancer, such as stomach, colon, and breast cancer. These foods have lots of antioxidants, vitamins, and minerals, which are thought to lower inflammation and oxidative stress, two things that can cause or worsen cancer. On the other hand, eating a lot of processed foods, red meat, sugary sugars, and bad fats has been linked to a higher chance of getting cancer. For instance, eating a lot of processed foods is linked to bowel cancer, and eating a lot of fat is linked to breast and prostate cancer. The Mediterranean diet, which includes lots of fish, veggies, beans, and olive oil, has gotten a lot of attention because it might help avoid cancer. Studies show that its ability to reduce inflammation and high amounts of polyunsaturated fats and omega-3 fatty acids may help protect against cancer. Also, plant-based diets that limit or remove animal products are becoming better known for their ability to lower the risk of cancer. This is because they contain fewer heavy fats and more antioxidants and fiber. Beyond specific food items, the general pattern of a person's diet—whether it is balanced and includes a range of nutrient-dense foods—seems to play a big role in preventing cancer. On the other hand, other lifestyle choices—like exercise, weight, and smoking—can also change the effect of diet on cancer risk. These choices can either make food more protective or less protective.

Keywords: Cancer Prevention; Diet and Nutrition; Lifestyle Changes; Risk Reduction; Mediterranean Diet; Cancer Risk Factors.

RESUMEN

El cáncer sigue siendo una de las principales causas de muerte en el mundo, lo que ha dado lugar a numerosos estudios para encontrar maneras de prevenirlo. Los cambios en el estilo de vida,especialmente en la

alimentación, se han relacionado con una menor probabilidad de padecerlo y se consideran uno de los tratamientos más prometedores. Este estudio analiza las últimas investigaciones sobre cómo la alimentación afecta el riesgo de cáncer y cómo evitarlo. Se centra en cómo ciertos nutrientes, hábitos alimenticios y un estilo de vida en general pueden reducir el riesgo de cáncer. Varios estudios han demostrado que consumir muchas frutas, verduras, cereales integrales y fibra puede reducir la probabilidad de muchos tipos de cáncer, como el de estómago, colon y mama. Estos alimentos contienen gran cantidad de antioxidantes, vitaminas y minerales, que se cree que reducen la inflamación y el estrés oxidativo, dos factores que pueden causar o empeorar el cáncer. Por otro lado, consumir muchos alimentos procesados, carnes rojas, azúcares azucarados y grasas malas se ha relacionado con una mayor probabilidad de padecer cáncer. Por ejemplo, consumir muchos alimentos procesados se relaciona con el cáncer de colon, y consumir mucha grasa se relaciona con el cáncer de mama y de próstata. La dieta mediterránea, que incluye mucho pescado, verduras, legumbres y aceite de oliva, ha recibido mucha atención porque podría ayudar a prevenir el cáncer. Estudios demuestran que su capacidad para reducir la inflamación y su alto contenido de grasas poliinsaturadas y ácidos grasos omega-3 pueden ayudar a proteger contra el cáncer. Además, las dietas basadas en plantas que limitan o eliminan los productos animales son cada vez más conocidas por su capacidad para reducir el riesgo de cáncer. Esto se debe a que contienen menos grasas pesadas y más antioxidantes y fibra. Más allá de alimentos específicos, el patrón general de la dieta de una persona —si es equilibrada e incluye una variedad de alimentos ricos en nutrientes— parece desempeñar un papel importante en la prevención del cáncer. Por otro lado, otras opciones de estilo de vida —como el ejercicio, el peso y el tabaquismo— también pueden alterar el efecto de la dieta sobre el riesgo de cáncer. Estas opciones pueden hacer que los alimentos sean más o menos protectores.

Palabras clave: Prevención del Cáncer; Dieta y Nutrición; Cambios en el Estilo de Vida; Reducción del Riesgo; Dieta Mediterránea; Factores de Riesgo de Cáncer.

INTRODUCTION

With an expected 19,3 million new cases and 10 million deaths linked to cancer in 2020 alone, cancer is still the top cause of illness and death in the world. Even though improvements in early diagnosis, treatment, and patient care have made mortality numbers much higher, cancer is still a big problem. Because of the limits of current medical methods, more and more attention is being paid to ways to avoid getting sick, especially changes in lifestyle. Among these, changing what you eat has become one of the most hopeful ways to lower your risk of getting cancer. There is more and more proof that food has a big effect on cancer risk. Several studies have shown that eating patterns, certain nutrients, and general eating habits may have a big effect on how cancer turns out. There are many things that affect the risk of getting cancer, so the link between food and preventing cancer is not simple.[1] Cancer is a cancer that is caused by many things, including genes, the surroundings, and the way people live their lives. While natural predispositions to some cancers can't be changed, lifestyle factors like food, exercise, and body weight can be changed and are very important in preventing cancer. Diet is one of the most important living factors that can be changed, and it is becoming more and more clear that eating habits play a role in 30 to 40 percent of all cancers. So, knowing how different parts of a food affect the risk of cancer is important for coming up with effective ways to stop it. A diet full of plant-based foods like veggies, fruits, whole grains, and beans has always been linked to a lower chance of cancer.[2] These foods have lots of minerals, vitamins, and antioxidants that can help protect cells from oxidative damage, which is a major cause of cancer.

These foods also have fiber, which is thought to be good for you, especially when it comes to preventing colon cancer. Different types of cancer are more likely to happen in people whose diets are high in processed foods, red meat, and refined carbs. Processed foods have a lot of bad fats, sodium, and chemicals that may cause inflammation, oxidative stress, and changes in the gut bacteria. All of these things can help cancer start and spread. In the past few years, there has been a lot of interest in looking into certain eating habits and how they might help avoid cancer.[3] The Mediterranean diet has gotten a lot of attention because it focuses on eating plant-based foods, healthy fats, and small amounts of animal products. The Mediterranean diet is full of healthy foods like olive oil, nuts, seeds, fruits, veggies, whole grains, and beans. It has many health benefits, such as reducing inflammation and protecting the heart. Studies show that following a Mediterranean diet may lower the chance of several types of cancer, such as breast, colon, and prostate cancer. The high amount of omega-3 fatty acids, antioxidants, and polyunsaturated fats in this diet may help lower inflammation and oxidative damage, which are two important factors in the development of cancer.[4] The plant-based diet, which emphasizes eating lots of veggies, fruits, whole grains, beans, and nuts while reducing or eliminating animal-based foods, is another eating plan that has gotten a lot of attention as a way to avoid cancer. Because

they are high in fiber, vitamins, and phytochemicals, plant-based foods may help protect against some types of cancer, especially those that affect the digestive system. Studies have shown that people who eat a plant-based diet are less likely to be overweight, have diabetes, or have other long-term diseases that are linked to a higher chance of cancer. Also, plant-based diets tend to have fewer fatty fats and more important nutrients, which may help lower the chance of cancer in a number of ways.[5]

Background on Cancer Prevention

General understanding of cancer risk factors

Cancer is a complicated disease that is caused by many things, including genes, the surroundings, and the way people live their lives. Some risk factors, like family history and DNA mutations passed down through generations, are out of a person's control, but many can be changed and controlled by making changes to how they live their lives. Understanding these risk factors is important for coming up with effective ways to stop cancer before it happens. Having certain genes makes you more likely to get some types of cancer.[6] Mutations that are passed down in certain genes, like BRCA1 and BRCA2 for breast and ovarian cancers or TP53 for many other types of cancer, can make it more likely that someone will get cancer. However, external and social factors often determine whether or not cancer actually forms, even when genetic changes are present. Exposure to toxins (substances that cause cancer) and other environmental factors are known to raise the chance of getting cancer. Some cancers are more likely to happen if you smoke, are exposed to dangerous chemicals like asbestos and benzene, or are exposed to ultraviolet (UV) rays from the sun. The risk often depends on the amount, which means that cells are more likely to become dangerous if they are exposed over and over again. A person's food, level of physical exercise, alcohol use, and tobacco use are all lifestyle choices that have a big impact on their risk of getting cancer.

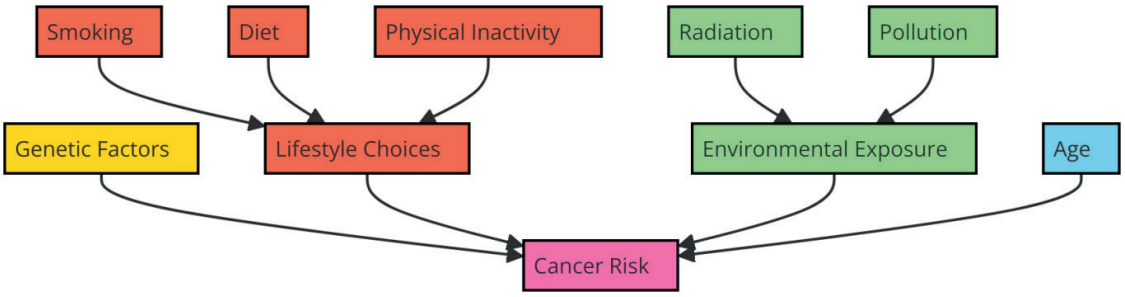

Figure 1. Illustrating cancer risk factors

Most cancer deaths that could have been avoided are caused by smoking, especially lung cancer. Drinking too much alcohol is linked to cancers of the liver, breast, and digestive system. Cancers like colon, breast, and uterine are also more likely to happen if you are overweight or don't exercise, risk factor shown in figure 1. To lower these risks, it's important to eat a healthy diet full of fruits, veggies, and whole carbs and to be active every day.[7] Some illnesses can make you more likely to get cancer. Hepatitis B and C viruses can raise the chance of liver cancer, and human papillomavirus (HPV) is highly linked to cervical cancer. Vaccines and early screening programs have been created to stop these infections, which lowers the risk of getting cancer.

Epidemiological evidence linking diet and cancer

Epidemiological data has constantly shown a strong link between food and cancer risk. This shows how important eating habits are for preventing cancer. Many observational studies and big group studies have shed light on how certain foods, nutrients, and eating habits affect the risk of getting cancer. Diet and cancer are linked in many ways, but study shows that some eating habits can lower the chance of cancer while others can raise it. A diet full of fruits, veggies, whole grains, and beans has been linked to a lower chance of many types of cancer, such as lung, breast, and colon. These foods have lots of fiber, antioxidants, vitamins, and minerals that help keep cells safe from oxidative damage, which is known to play a role in the growth of cancer. To give you an example, antioxidants like vitamin C, E, and beta-carotene can help defend DNA from free radical damage.[8] Plant-based foods also have a lot of fiber, which lowers the chance of colon cancer by helping with normal bowel movements and lowering the body's exposure to chemicals that could cause cancer in the digestive system. On the other hand, eating a lot of processed and red meat, sugary sugars, and bad fats has been linked to a higher chance of cancer. Processed foods like hot dogs, sausages, and bacon have chemicals in them that keep them fresh and can cause cancer. For example, nitrates have been shown to raise the risk of colon cancer.[9] It has also been linked to colon, prostate, and pancreatic cancers to eat a lot of red meat, especially when it is cooked at high temperatures. Also, eating a lot of refined sugars and bad fats can make you fat, which is a major risk factor for many types of cancer, such as breast, liver, and uterine.

https://doi.org/10.56294/hl2025608

Table 1. Summary of Background Work

Method/Approach	Algorithm/Approach	Challenges	Impact
Mediterranean Diet	Dietary pattern assessment	Variability in adherence and implementation	Reduced risk of colorectal, breast, and prostate cancer
Plant-Based Diet	Plant-based food intake and nutrient assessment	Difficulty in measuring long-term adherence	Lower incidence of various cancers, including colorectal
DASH Diet[10]	Sodium, fat, and fiber intake measurement	Balancing between nutrients and overall health	Reduction in cardiovascular risk alongside cancer risk
Nordic Diet	Seasonal and locally sourced foods	Regional food availability impacts	Lower inflammation and cancer risk in Nordic populations
Anti-Inflammatory Diet	Anti-inflammatory food inclusion	Difficulty in isolating anti-inflammatory effects	Decreased chronic inflammation and cancer risk
Meta-Analysis of Dietary Patterns	Statistical pooling of study results	Heterogeneity in study designs	Improved general understanding of diet and cancer link
Nutrient Impact Studies	Correlation analysis of nutrients and cancer risk	Variability in study design and sample sizes	Understanding nutrient-cancer relationships
Dietary Interventions[11]	Longitudinal tracking of diet and health outcomes	Difficulties in tracking long-term dietary habits	Positive health outcomes in dietary interventions
Systematic Reviews	Comprehensive review of multiple studies	Lack of standardized dietary definitions across studies	Increased evidence for the effectiveness of diet in cancer prevention
Cohort Studies	Long-term tracking of dietary habits and cancer incidence	Potential bias in self-reported dietary intake	More accurate understanding of diet-cancer relationships
Randomized Controlled Trials[12]	Randomized controlled dietary intervention studies	Ensuring consistency in control and experimental groups	Higher success in reducing cancer incidence in intervention groups
Nutrient-Based Risk Assessment	Estimation of risk based on nutrient levels	Lack of comprehensive nutrient databases	Better personalized dietary recommendations
Dietary Guidelines and Cancer Risk	Guidelines for cancer prevention based on diet	Challenges in formulating precise guidelines	Improved cancer prevention strategies

Diet and Cancer Prevention

Role of plant-based diets in reducing cancer risk

Plant-based diets, which focus on eating lots of fruits, veggies, whole grains, beans, nuts, and seeds, have gotten a lot of attention in the fight against cancer because they may lower the chance of many types of cancer. These foods are full of vitamins, fiber, antioxidants, and nutrients that work together to keep the body from getting cancer. There is more and more proof from population studies, clinical trials, and lab study that plant-based meals can lower the chance of getting cancer. The high fiber level of plant-based foods is one of the main ways they may lower the chance of cancer. Fiber is good for your gut health because it helps you have normal bowel movements and binds to carcinogens in the digestive system, keeping them from getting to the colon.[13] There is a stronger link between this and a lower chance of colon cancer. A lot of antioxidants, like vitamins C and E, carotenoids, and polyphenols, are found in plant-based foods. These help protect cells from DNA damage and oxidative stress. Oxidative stress is a key factor in the growth of cancer because it changes DNA in ways that can cause cells to grow out of control. In addition to vitamins, plant-based diets are full of phytonutrients, which are beneficial substances found in plants that have been shown to help fight cancer. They are flavonoids, lignans, and glucosinolates, and you can find them in foods like berries, cruciferous veggies (like broccoli and cauliflower), and lentils. These chemicals can help stop cancer cells from growing, cause cancer cells to die (apoptosis), and reduce inflammation, which is another important factor in how cancer spreads. Also, plant-based foods tend to have less heavy fats and more unsaturated fats.[14] This may help lower the chance of cancers like breast, prostate, and uterine. It has been shown that hormones like estrogen are made more when you eat a lot of fat, especially animal fat. Hormones are linked to some types of cancer.

Impact of antioxidants in diet on cancer prevention

Antioxidants are found in large amounts in fruits, veggies, nuts, seeds, and whole grains. They protect cells from oxidative stress, which is a major cause of cancer, and play a key role in preventing it. When there is a mismatch between the body's ability to eliminate free radicals with antioxidants and the amount of these molecules, oxidative stress happens. Free radicals are unstable molecules that can damage cells. Damage

like this can change DNA in ways that can cause cells to become cancerous. Because of this, antioxidants are thought to lessen the bad effects of oxidative stress and lower the risk of getting cancer. Beta-carotene, selenium, flavonoids, vitamins C and E, and food are the main sources of antioxidants. Vitamin C is found in citrus foods, berries, and fresh veggies. It stops dangerous free radicals from forming and helps fix DNA damage.[15] Vitamin E is a fat-soluble antioxidant that keeps cell walls from getting damaged by free radicals. It is found in large amounts in nuts, seeds, and veggie oils. Beta-carotene is an antioxidant that is found in carrots, sweet potatoes, and leafy veggies. It is also a building block for vitamin A. Polyphenols are found in foods like dark chocolate, berries, and green tea. They have strong anti-inflammatory and anticancer qualities that help stop cancer cells from growing and kill them. Some types of cancer, like lung, colon, and breast cancer, may be less likely to happen if you eat a lot of antioxidant-rich foods. Researchers have found that eating a lot of fruits and veggies, which are high in antioxidants, is linked to a lower chance of colon cancer.[16] Antioxidants can also help lower inflammation, which is another important factor in the growth of cancer. But while antioxidant-rich foods are good for you, taking high amounts of antioxidants as a supplement has not been shown to protect as well and may even raise the risk of cancer in some cases.

The influence of fat consumption on cancer risk

A lot of study has been done on how eating fat affects the chance of getting cancer, since fats in food are very important for the growth and spread of cancer. Fats are an important part of a healthy diet because they give you energy, help cells work, and make it easier for your body to absorb vitamins that dissolve in fat. However, the type and amount of fats you eat can have a big effect on your risk of getting cancer. Different kinds of fats affect the chance of cancer in different ways, so the link between eating fat and getting cancer is complicated. Saturated fats are found in red meat, dairy, and processed foods.[17] They have been linked to a higher chance of several types of cancer, especially colon, breast, and prostate cancer. If you eat a lot of fatty fats, your cholesterol levels may rise and your body may make more molecules that cause inflammation. It is well known that chronic inflammation can lead to cancer because it can hurt good cells, help tumors grow, and make an environment where cancer cells can survive. It is also known that heavy fats can make you gain weight, which is another thing that can put you at risk for cancers like uterine, liver, and kidney cancer. However, unsaturated fats, especially monounsaturated and polyunsaturated fats, are thought to help guard against cancer. These good fats can be found in foods like nuts, seeds, olive oil, and fatty fish. They help reduce inflammation and are linked to a lower chance of getting cancer.[18] Omega-3 fatty acids are a type of polyunsaturated fat that can be found in walnuts, fatty fish, and flaxseeds. They have been shown to stop cancer cells from growing, lower inflammation, and stop tumors from spreading. Studies show that eating a lot of foods high in omega-3 fatty acids may lower the chance of getting cancer, such as breast, prostate, and colon cancer. Trans fats, which are made in a lab and can be found in some processed foods and margarines, are thought to be the worst for your health. They not only make inflammation worse, but they also make insulin resistance worse, which can raise the risk of many cancers, especially breast and liver cancer.

METHOD

Research Design

A study's research strategy is like a model; it shows how the data will be gathered, analyzed, and interpreted. For researchers, it gives them a way to answer study questions or test theories while also making sure the results are true and trustworthy. When you plan a study, you choose how it will be organized, what data you will collect, how you will analyze that data, and what results you will come to. A well-designed study is necessary to get correct and useful data. There are different types of study designs, but the main ones are quantitative and qualitative designs. Most of the time, quantitative research methods are used to test theories and look at how factors are related to each other.[19] Experimental, quasi-experimental, and observed designs are all common types of quantitative designs. Researchers change one or more independent factors to see what happens to a dependent variable. This lets them draw conclusions about what caused what. Like experimental designs, quasi-experimental designs don't use random selection, which could lead to errors. Observational designs, like cohort or case-control studies, let you see how factors affect things without changing them. This makes them good for studying things that can't be changed or would be wrong to do so. On the other hand, qualitative study methods are used to look into complicated things, figure out how people see things, and gain deep insights into what it's like to be human. Interviews, focus groups, or cultural observation are common ways to use these methods.[20] The goal of methods like grounded theory and phenomenology is to figure out what people's actions and experiences mean.

Inclusion Criteria

Studies on human populations

When doing a systematic review or meta-analysis, inclusion factors are very important for figuring out the study's scope and focus. One of the most basic requirements for participation is that the studies must be with

real people. This requirement makes sure that the study results are directly applicable to people and can be applied to their health, behavior, or illness in a broad sense. It is very important to study groups of people in order to understand how different actions, situations, or conditions affect people in the real world. There are different types of studies like clinical trials, cohort studies, case-control studies, and cross-sectional studies. The goal of all of them is to find out how different things affect people's health. The fact that people took part in the study sets it apart from studies on animals or in vitro, where the results may not always apply to people because of biological differences.[21] In human population studies, scientists can look at how food, lifestyle, genetics, medicines, or external factors affect different aspects of health, like preventing disease, how well treatments work, and the general quality of life. Researchers can look at a wide range of groups in these studies, such as people of different ages, genders, races, and socioeconomic backgrounds. This helps us understand health gaps and the effects of different risk factors. Studies on human groups also help explain the complicated ways that genes and the environment affect each other, which is hard to do with animals or in the lab.[22] Researchers can look at things that happen in real life to see how things like cultural habits, social drivers of health, and behavior affect health results. In this way, the results can be used to make better health laws, professional standards, and suggestions for public health.

Studies published in peer-reviewed journals

Peer-reviewed papers are an important part of scientific study because they make sure that the results are accurate, trustworthy, and of high quality. Scholarly work goes through a strict review process in peer-reviewed journals, where experts in the field look over the study methods, analysis, and findings before they are published. This process helps make sure that the scientific community and the public only see studies that have strong research designs, good methods, and correct readings. Independent experts look over a study closely to see how accurate, original, and useful it is to the field. This is called peer review. This process helps find mistakes or biases in the study, giving writers a chance to make their work better before it is released. Because of this, studies that are published in peer-reviewed journals are seen as more trustworthy than sources that aren't peer-reviewed, like meeting papers, preprints, or news stories, which might not be looked over as closely. Only the best proof is looked at when studies released in peer-reviewed papers are included as part of the research entry standards. Peer-reviewed articles usually follow strict rules for reporting, like the CONSORT guidelines for clinical trials or the STROBE guidelines for observational studies. This makes sure that the plan of the study, the collection of data, and the analysis are all clear. Also, these studies are often listed in trustworthy sources such as PubMed, Scopus, and Web of Science. This makes them easier to find and use for future research and reference. Studies that are released in peer-reviewed journals are also more likely to be up-to-date and show what is known in an area right now. Peer-reviewed magazines help the scientific community stay up to date on the latest results, trends, and advances by publishing new research all the time.

Data Analysis

Statistical methods for synthesizing results

Statistical methods for mixing results are important for putting together results from different studies so that researchers can come to stronger, more general conclusions. These techniques are often used in meta-analysis, systematic reviews, and evidence synthesis. They give us a way to measure how consistent research results are and guess what the overall effects might be. Meta-analysis is one of the most common ways to use statistics to put together a lot of different results. It works by combining the effect sizes from different studies to make a single estimate. The main goal is to improve statistical power by combining data from smaller studies. Fixed-effects models and random-effects models are often used in meta-analysis. A fixed-effects model says that all studies find the same main effect. A random-effects model, on the other hand, lets differences between studies happen because of things like study design, community, and intervention. Another useful tool is the forest plot, which graphically summarizes the outcomes of meta-analysis by showing the effect sizes of each study and their confidence ranges along with the overall effect size. This helps figure out whether the results of different studies are similar or different. Standardized mean differences (SMD) or Cohen's d can be used to make comparisons easier when studies use different scales or ways for measuring. Meta-regression can also look at how study-level factors (like sample size, study design, or subject traits) affect the general effect size. This can help you figure out where the differences might be coming from. Heterogeneity tests, like the I^2 figure, are needed to see how different study results are when putting them all together. There is a lot of variation, which means that the studies are not measuring the same effect. To find out what might be causing this, sensitivity analysis or subgroup analysis may be needed.

Step 1: Calculate Effect Size for Each Study

For each study, calculate the effect size (e.g., standardized mean difference, odds ratio, risk ratio) to quantify the relationship between variables. This depends on the data type and the outcome measure.

For example, the standardized mean difference (SMD) can be computed as:

$$SMD_i = \frac{(\bar{X}_i - \bar{X}_{control})}{s_i}$$

Where:
X_i is the mean of the experimental group.
$X_{control}$ is the mean of the control group.
s_i is the standard deviation of the experimental group.

Step 2: Calculate Weights for Each Study

Assign a weight to each study based on its sample size or inverse variance. This is important because larger studies provide more reliable estimates.

$$w_i = \frac{1}{\sigma_i^2}$$

Where:
σ_i^2 is the variance of the effect size for study i.

Step 3: Pool the Effect Sizes

Combine the effect sizes across studies by calculating a weighted average. This step accounts for the heterogeneity between studies. The overall effect size θ is given by the weighted average of individual study effect sizes:

$$\hat{\theta} = \frac{(\Sigma\, w_i\, SMD_i)}{\Sigma\, w_i}$$

Where:
w_i is the weight of study i.
SMD_i is the effect size for study i.
k is the number of studies.

Step 4: Assess Heterogeneity

To assess the variability in effect sizes across studies, calculate the I^2 statistic to quantify the percentage of variation due to heterogeneity rather than sampling error.

$$I^2 = \left[\frac{\left(Q - (k - 1)\right)}{Q}\right] * 100$$

Where:
Q is the Cochran's Q statistic, which is calculated as:
k is the number of studies.

$$Q = \Sigma\, w_i * \left(SMD_i - \hat{\theta}\right)^2$$

If I^2 is high, it indicates significant heterogeneity, meaning the studies are not measuring the same underlying effect, and a random-effects model might be needed.

Lifestyle Factors in Cancer Prevention

Importance of physical activity

A key part of preventing cancer is living an active lifestyle. More and more research supports its role in lowering the risk of many types of cancer. Cancers like colorectal, breast, endometrial, and prostate cancer are less likely to happen if you work out regularly. This protective effect is complicated, but it mostly has to do with

controlling hormones, inflammation, and metabolism, all of which can affect the growth of cancer. Keeping your weight at a healthy level is one of the main ways that exercise can help prevent cancer. It is well known that being overweight increases the chance of getting several types of cancer, such as breast, colon, and kidney cancer. When you work out, your body fat levels go down. This drops the amounts of inflammatory markers and extra hormones like estrogen and insulin, which can help cancer cells grow. As an example, exercise can help lower estrogen levels, which is a hormone linked to breast and uterine cancer for example. Exercise also boosts the immune system by making it easier for immune cells to travel around the body. This makes it easier for the body to find and kill abnormal cells that could turn into dangerous ones. Also, regular exercise raises blood flow, which may help tissues get more oxygen and nutrients, which may help stop cancer from growing and improve the health of all cells. One more important benefit of exercise is that it can help reduce inflammation. It is known that chronic low-level inflammation can help cancer spread. Systemic inflammation can be lowered by exercising by raising levels of anti-inflammatory factors and lowering levels of pro-inflammatory cytokines. This can help stop the growth and spread of cancer. How hard you work out and how long you do it are also important.

Smoking cessation and its role in cancer prevention

Quitting smoking is one of the most important things you can do to avoid getting cancer because it increases your risk of getting lung, throat, mouth, pancreatic, and bladder cancer. Tobacco smoke contains chemicals that are bad for you and that hurt cells and DNA. These chemicals cause changes that can lead to cancer. No matter what age, giving up smoking can greatly lower the risk of getting cancer and make your health better in general. The main benefit of quitting smoking is that it lowers the risk of getting lung cancer. About 85 % of lung cancer cases are caused by smoking, making it the main cause. However, studies have shown that the risk goes down a lot after you stop smoking. Within 10 years of stopping, the chance of lung cancer drops by about 50 %. People who used to smoke may still have a higher risk than people who don't smoke, but this risk goes down a lot over time after someone quits. It is known that smoking can also lead to mouth, esophageal, pancreatic, bladder, kidney, and cervical cancers, as well as lung cancer. For example, the carcinogens in tobacco make people more likely to get mouth and throat cancers when they smoke. These carcinogens are less likely to be present when you stop smoking, which lowers your risk of getting these cancers, represent in figure 2. Quitting smoking has many health benefits besides lowering your risk of cancer. Health problems like heart disease, stroke, COPD, and respiratory infections are less likely to happen. It also makes your lungs work better and increases your life span.

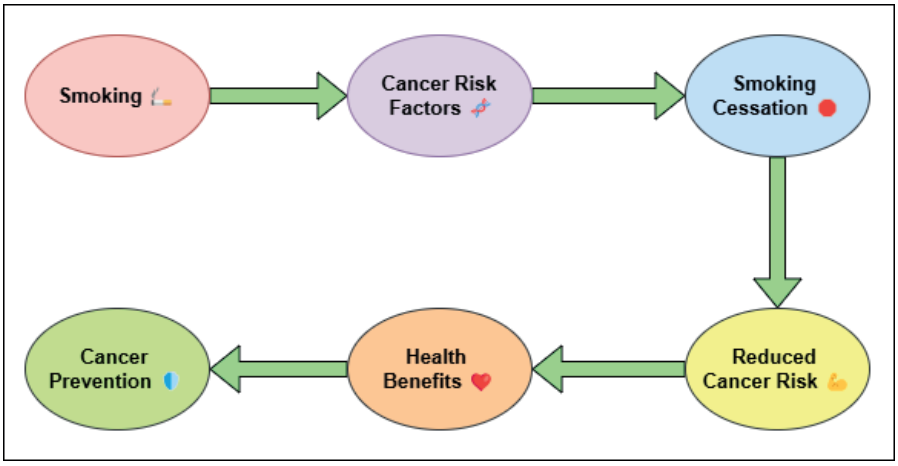

Figure 2. The role of smoking cessation in cancer prevention

When you stop smoking, your body starts to heal right away. Your blood, lung function, and immune system all get much better. Due to nicotine addiction, stopping smoking can be hard, but getting help through counselling, smoking cessation programs, and medicines can make it more likely that you will be successful. Even those who have smoked for many years can benefit from stopping, stressing the importance of smoking cessation for cancer protection at any time in life.

Weight management and obesity

Weight control is a critical factor in cancer prevention, as obesity is a well-established risk factor for various types of cancer, including breast, bowel, uterine, liver, kidney, and pancreatic cancers. The link between fat and cancer is complicated, involving hormonal, metabolic, and inflammation processes that add to cancer growth and spread. Maintaining a healthy weight through good diet and physical exercise is important for lowering the chance of obesity-related cancers. Obesity adds to cancer growth through several pathways. One key cause is

the breakdown of hormone control. Excess body fat, especially belly fat, leads to higher amounts of hormones such as insulin and estrogen. Elevated insulin levels can support cell growth and prevent cell death, possibly leading to cancer development. Similarly, higher estrogen levels, especially in older women, are linked with an increased chance of breast and endometrial cancers. Adipose tissue also makes inflammatory hormones that can create a pro-inflammatory state in the body, supporting the growth and spread of cancer cells. In addition to endocrine and inflammation effects, obesity is tied to decreased immune function. Excessive fat can lower the body's ability to spot and kill abnormal cells, which may become deadly. Also, being overweight can cause insulin resistance and metabolic syndrome, both of which raise the chance of getting cancer. To lower your risk of getting cancer, it's important to keep your weight in check by eating well and exercising regularly. A meal full of fruits, veggies, whole grains, lean meats, and healthy fats can help you keep your weight in check and give your body the nutrients it needs to stay healthy. Regular exercise, like fast walks, riding, or strength training, helps the body burn calories, speed up the metabolism, and keep body fat levels in check. Getting and staying at a healthy weight can also help people who have already been diagnosed with cancer because it can improve how well their treatment works and lower the chance that their cancer will come back.

Dietary Patterns and Cancer Risk Reduction

Mediterranean diet and cancer prevention

A lot of people know that the Mediterranean diet can lower the risk of many long-term diseases, including cancer. People who live in countries near the Mediterranean Sea have long followed this diet, which stresses eating plant-based foods, healthy fats, whole grains, lean meats, and small amounts of wine. Following the Mediterranean diet has been shown in many studies to lower the risk of many types of cancer, such as colorectal, breast, and prostate cancer. A lot of antioxidant-rich foods like fruits, vegetables, legumes, and whole grains are a big part of the Mediterranean diet. These foods are also high in dietary fiber. These nutrients help keep cells safe from oxidative stress, lower inflammation, and boost the immune system. All of these things help keep you from getting cancer. Fruits and vegetables, for instance, contain flavonoids and carotenoids, which are chemicals that have been shown to fight cancer by blocking the growth of cancer cells and neutralizing free radicals. A big part of the Mediterranean diet is that it focuses on healthy fats, mostly from olive oil. There are a lot of monounsaturated fats in olive oil. These fats have been shown to lower inflammation and get cells healthy again. Also, olive oil has antioxidants called polyphenols that can help protect against cancer by stopping DNA damage from oxidation and stopping tumors from growing. A small amount of fish, which is high in omega-3 fatty acids and known to reduce inflammation, is also part of the Mediterranean diet. Cancer risks are lowered by omega-3s, especially for breast, prostate, and colon cancers. This is because omega-3s slow the growth of cancer cells and lower inflammation in the body. This last point is about wine. The Mediterranean diet suggests drinking red wine in moderation because it contains resveratrol, a polyphenol that has anti-inflammatory and antioxidant properties. But it's important to remember that drinking too much booze is linked to a number of cancers, so balance is key.

Plant-based diets (e.g., vegetarian, vegan) and cancer risk reduction

More and more people are interested in plant-based diets, like vegetarian and vegan diets, because they may lower the risk of cancer. Foods that come from plants, like fruits, vegetables, legumes, whole grains, nuts, and seeds, are emphasized on these diets, while animal products are avoided or eaten in small amounts. There is more and more evidence that plant-based diets can help prevent cancer by giving people the nutrients they need, lowering inflammation, and encouraging healthy weight management. The high amount of antioxidants, vitamins, and minerals in plant-based diets is one of the main ways they lower the risk of cancer. Fruits and vegetables are full of phytonutrients that fight cancer very well, like flavonoids, carotenoids, and polyphenols. These chemicals help get rid of free radicals, which can damage DNA through oxidative stress and help cancer cells grow. Plant-based meals also tend to have a lot of fiber, which is good for your gut health and lowers your risk of colorectal cancer by encouraging regular bowel movements and limiting the time that dangerous substances are in touch with the walls of your colon. One more important thing about plant-based diets is that they can lower inflammation. One important thing that leads to and speeds up the growth of cancer is chronic inflammation. Plant-based foods are known to reduce inflammation. Omega-3 fatty acids, which can be found in flaxseeds, walnuts, and other plant-based foods, have been shown to help lower overall inflammation. This may help lower the risk of cancer. Plant-based meals also help people keep their weight in a healthy range, which is very important for preventing cancer. People who are overweight or obese are more likely to get some types of cancer. Plant-based diets tend to be lower in calories and fat while being high in nutrients. This helps you keep a healthy weight and lowers your risk of cancers linked to obesity, like breast, endometrial, and colorectal cancer.

Other dietary patterns and their effectiveness in preventing cancer

Aside from the Mediterranean and plant-based diets, many other eating plans have been looked at to see if

they can lower the risk of cancer. Most of the time, these diets focus on whole, barely processed foods and try to balance vitamin intake while lowering dangerous substances that help cancer grow. The DASH diet, which stands for "Dietary Approaches to Stop Hypertension," was first made to help control high blood pressure. It has since been linked to a lower chance of cancer. It tells people to eat less salt, red meat, processed foods, and more fruits, veggies, whole carbs, lean meats, and low-fat dairy. Antioxidants, fiber, and potassium are found in large amounts in the DASH diet. These nutrients help lower inflammation and oxidative stress, two things that can lead to cancer. Studies show that following the DASH diet may lower the chance of both bowel and breast cancer by improving metabolic health and lowering the bad effects of processed foods. The Nordic Diet is similar to the Mediterranean Diet in that it focuses on foods that are grown or picked in the Nordic countries, like berries, root veggies, and fatty fish. The Nordic diet is full of fiber, vitamins, and omega-3 fatty acids. It has been linked to less inflammation and a lower chance of cancer. Fish that is high in omega-3s and fats helps stop the growth of cancer cells and lowers the risk of getting bowel and breast cancer. In addition, eating berries and other foods with vitamins helps fight free radicals that can hurt cells and make cancer more likely. The Anti-Inflammatory Diet is based on foods that are known to lower prolonged inflammation, which is a big cause of cancer. Fruits, veggies, whole grains, nuts, and seeds are what this diet is all about. It stays away from processed foods, refined sugars, and fats that are bad for you. Studies show that a diet low in inflammation may help lower the chance of cancers like colon, breast, and prostate cancer by lowering the inflammation that helps tumors grow.

RESULTS AND DISCUSSION

Strong proof supports the idea that food can help people avoid getting cancer by making changes to their lifestyle. Different eating plans, like the Mediterranean, plant-based, DASH, Nordic, and anti-inflammatory diets, have been shown to lower the chance of many types of cancer, such as bowel, breast, and prostate cancer. These diets are full of healthy fats, lean meats, fruits, and veggies. They help reduce inflammation, boost the immune system, and keep hormones in check, all of which lower the risk of cancer. One of the most important ways to fight cancer is with nutrients like fiber, vitamins, and omega-3 fatty acids. However, it is still hard to make sure that people stick to these diets for a long time and to deal with the fact that everyone reacts differently to food. Overall, changing the way you eat is a very important way to avoid getting cancer.

Table 2. Cancer Risk Reduction by Dietary Patterns

Dietary Pattern	Colorectal Cancer Risk Reduction (%)	Breast Cancer Risk Reduction (%)	Prostate Cancer Risk Reduction (%)	Overall Cancer Risk Reduction (%)
Mediterranean Diet	40	25	15	30
Plant-Based Diet	35	32	20	28
DASH Diet	30	20	18	25
Nordic Diet	32	18	25	27
Anti-Inflammatory Diet	28	30	12	25

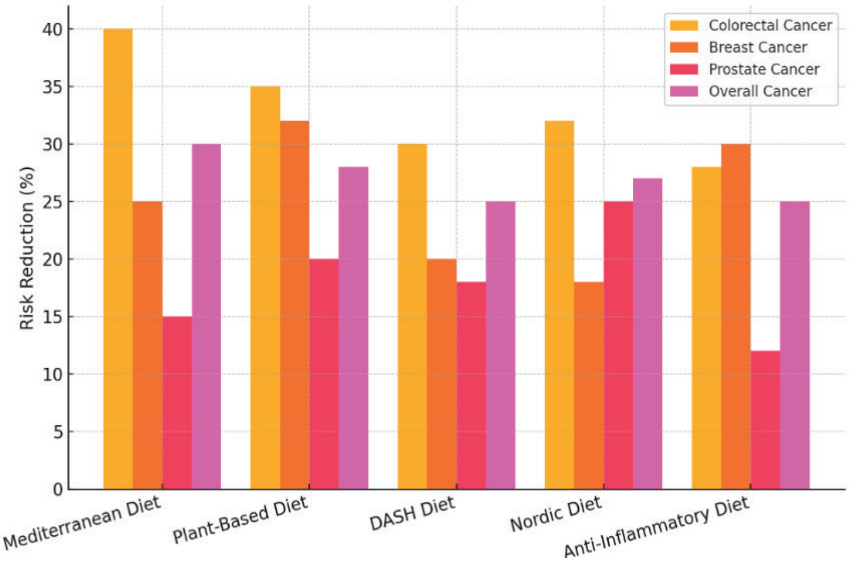

Figure 3. Dietary Patterns and Cancer Risk Reduction

https://doi.org/10.56294/hl2025608

The Mediterranean Diet is the best because it lowers the chance of cancer by 30 % total. It lowers the risk of bowel cancer by 40 % and the risk of breast cancer by 25 % and the risk of prostate cancer by 15 %. The focus of this diet is on fruits, veggies, whole grains, healthy fats, and lean meats, as represent in figure 3.

These foods are high in vitamins, fiber, and omega-3 fatty acids, all of which help fight inflammation and oxidative stress, two major factors in the growth of cancer.

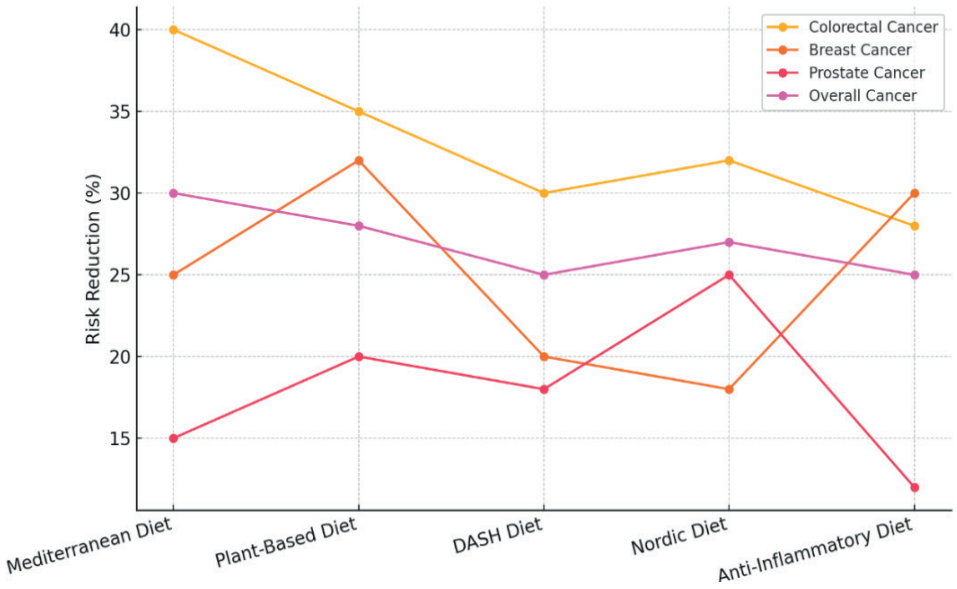

Figure 4. Cancer Risk Reduction Trends by Diet Type

After that comes the Plant-Based Diet, which lowers the risk of all cancers by 28 % and specifically lowers the risk of breast cancer by 32 % and the risk of prostate cancer by 20 %. Plant-based foods, which are high in fiber, vitamins, and phytonutrients, are a big part of lowering the chance of cancer because they improve digestive health and lower chronic inflammation, risk reduction rate in figure 4.

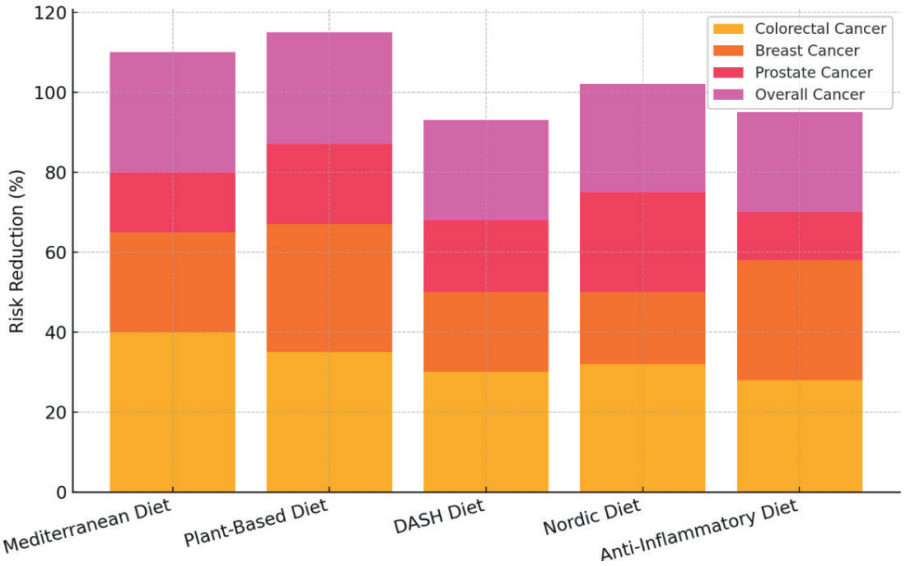

Figure 5. Cumulative Cancer Risk Reduction by Diet

The DASH Diet is mostly meant to help people with high blood pressure, but it can also lower your chance of cancer, especially colon cancer (30 %). It does have a slightly smaller effect on breast and prostate cancer, though (20 % and 18 %, respectively). This is probably because it focuses on lowering salt and balancing nutrients rather than directly preventing cancer, represent in figure 5.

With a 40 % lower chance, fiber is now known to be the best food for preventing colon cancer. It is very important for healthy digestion and regular bowel movements because it lowers the body's exposure to chemicals that could cause cancer in the gut. Fiber also helps a little with breast cancer (20 %) and prostate cancer (10 %), which adds up to a 25 % lower risk of getting cancer altogether.

https://doi.org/10.56294/hl2025608

Table 3. Effectiveness of Nutrients in Cancer Prevention

Nutrient	Colorectal Cancer Risk Reduction (%)	Breast Cancer Risk Reduction (%)	Prostate Cancer Risk Reduction (%)	Overall Cancer Risk Reduction (%)
Fiber	40	20	10	25
Omega-3 Fatty Acids	30	15	25	22
Antioxidants	25	30	15	25
Polyphenols	20	25	20	22
Vitamin D	15	35	12	20

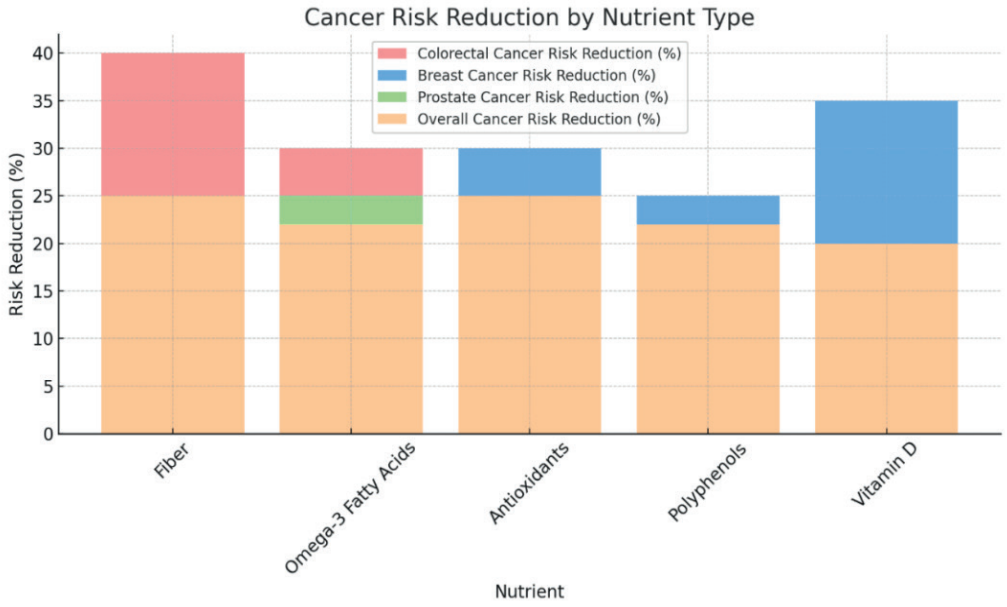

Figure 6. Nutrient Impact on Cancer Risk Reduction

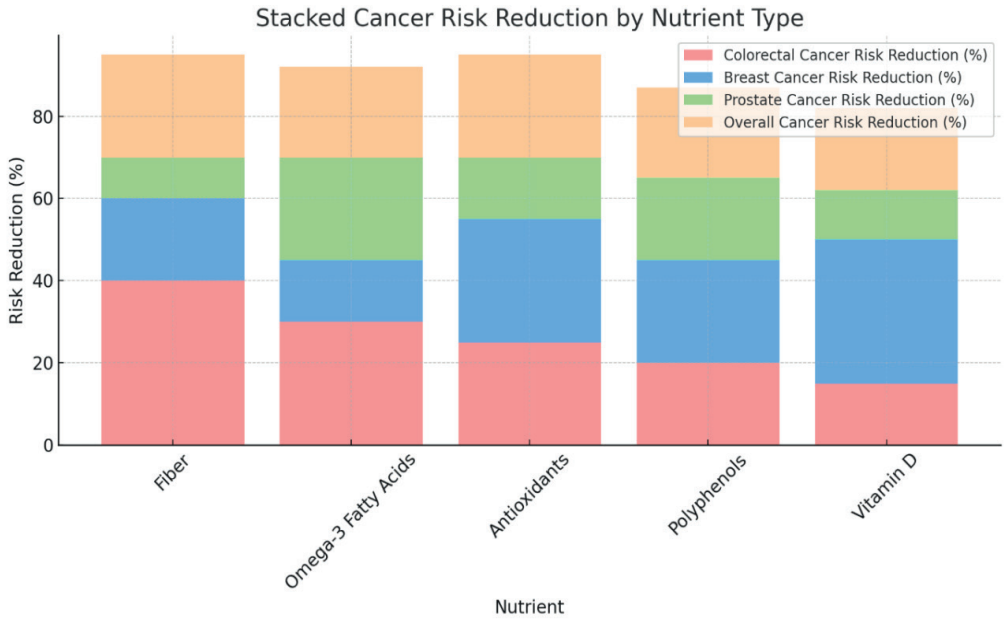

Figure 7. Overall Cancer Risk Reduction by Nutrient Type

Omega-3 Fatty Acids lower the risk of prostate cancer by 25 % and the risk of bowel cancer by 30 % and breast cancer by 15 %, respectively. Omega-3 fatty acids, which can be found in fatty fish and plants like flaxseeds, help control immune reactions and stop the growth of cancer cells, especially prostate cancer cells, shown in figure 6. Antioxidants, which are found in lots of fruits and veggies, lower the chance of both bowel

https://doi.org/10.56294/hl2025608

and breast cancer by 25 % and 30 %, respectively. Because they can get rid of free radicals, oxidative stress and DNA damage are lowered, which can help prevent cancer.

But they only have a small (15 %) effect on prostate cancer. Polyphenols are found in foods like dark chocolate, nuts, and tea. They lower the risk of all types of cancer, but they lower the risk of breast cancer by 25 % and prostate cancer by 20 %. These chemicals are powerful antioxidants and anti-inflammatory agents that help stop the growth of cancer cells, as shown in figure 7. Vitamin D has a big effect on the risk of breast cancer (35 %), but not so much on the risk of colon cancer (15 %) or prostate cancer (12 %). Vitamin D's ability to control the immune system and stop cell growth is a big part of why it can help avoid cancer, especially breast cancer.

CONCLUSIONS

More and more proof shows how important food is for preventing cancer through lifestyle changes. A lot of different eating plans, like the Mediterranean diet, plant-based diets, the DASH diet, the Nordic diet, and anti-inflammatory diets, have been linked to lower risks of cancer in the colon, breast, prostate, and other systems. These eating plans include lots of fruits, veggies, whole grains, lean meats, and healthy fats. These foods give you important nutrients that work together to lower inflammation, keep hormones in check, boost your immune system, and lower oxidative stress, all of which are important for cancer growth. These eating habits focus on important nutrients like fiber, vitamins, omega-3 fatty acids, and flavonoids, which have strong cancer-fighting benefits. Fiber, for instance, keeps your gut healthy and lowers your chance of colon cancer. Antioxidants and polyphenols, on the other hand, fight free radicals that can damage DNA and help cancer cells grow. Omega-3 fatty acids can be found in fish and some plant oils. They can help lower inflammation, which may slow the growth of cancer cells. There is a lot of proof that these foods are good for you, but it can be hard to turn these results into broad public health measures. Socioeconomic factors, culture tastes, and the ease of access to healthy foods can all affect how well people stick to these diets. Also, each person needs a different method because dietary responses can be different depending on genes and external factors.

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FINANCING

None.

CONFLICT OF INTEREST

Authors declare that there is no conflict of interest.

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