



# American Cancer Society Guidelines on Nutrition and Physical Activity for Cancer Prevention

*This document is a condensed version of the article describing the American Cancer Society (ACS) Nutrition and Physical Activity Guidelines, which are updated about every 5 years. The guidelines were developed by the American Cancer Society Nutrition and Physical Activity Guidelines Advisory Committee. The full article (including references), which is written for health care professionals, is published in the January/February 2012 issue of CA: A Cancer Journal for Clinicians, and is available for free online at: <http://onlinelibrary.wiley.com/doi/10.3322/caac.20140/full>*

For most Americans who do not use tobacco, the most important cancer risk factors that can be changed are body weight, diet, and physical activity. One-third of all cancer deaths in the United States each year are linked to diet and physical activity, including being overweight or obese, while another third is caused by tobacco products.

Although our genes influence our risk of cancer, most of the difference in cancer risk between people is due to factors that are not inherited. Avoiding tobacco products, staying at a healthy weight, staying active throughout life, and eating a healthy diet may greatly reduce a person's lifetime risk of developing or dying from cancer. These same behaviors are also linked with a lower risk of developing heart disease and diabetes.

Although these healthy choices can be made by each of us, they may be helped or slowed by the social, physical, economic, and regulatory environment in which we live. Community efforts are needed to create an environment that makes it easier for us to make healthy choices when it comes to diet and physical activity.

## Summary of the ACS Guidelines on Nutrition and Physical Activity

<b>ACS RECOMMENDATIONS FOR INDIVIDUAL CHOICES</b>
<b>Achieve and maintain a healthy weight throughout life.</b>

<ul style="list-style-type: none"> <li>• Be as lean as possible throughout life without being underweight.</li> </ul>
<ul style="list-style-type: none"> <li>• Avoid excess weight gain at all ages. For those who are overweight or obese, losing even a small amount of weight has health benefits and is a good place to start.</li> </ul>
<ul style="list-style-type: none"> <li>• Get regular physical activity and limit intake of high-calorie foods and drinks as keys to help maintain a healthy weight.</li> </ul>
<p><b>Be physically active.</b></p>
<ul style="list-style-type: none"> <li>• <b>Adults:</b> Get at least 150 minutes of moderate intensity or 75 minutes of vigorous intensity activity each week (or a combination of these), preferably spread throughout the week.</li> </ul>
<ul style="list-style-type: none"> <li>• <b>Children and teens:</b> Get at least 1 hour of moderate or vigorous intensity activity each day, with vigorous activity on at least 3 days each week.</li> </ul>
<ul style="list-style-type: none"> <li>• Limit sedentary behavior such as sitting, lying down, watching TV, and other forms of screen-based entertainment.</li> </ul>
<ul style="list-style-type: none"> <li>• Doing some physical activity above usual activities, no matter what one's level of activity, can have many health benefits.</li> </ul>
<p><b>Eat a healthy diet, with an emphasis on plant foods.</b></p>
<ul style="list-style-type: none"> <li>• Choose foods and drinks in amounts that help you get to and maintain a healthy weight.</li> </ul>
<ul style="list-style-type: none"> <li>• Limit how much processed meat and red meat you eat.</li> </ul>
<ul style="list-style-type: none"> <li>• Eat at least 2½ cups of vegetables and fruits each day.</li> </ul>
<ul style="list-style-type: none"> <li>• Choose whole grains instead of refined grain products.</li> </ul>
<p><b>If you drink alcohol, limit your intake.</b></p>
<ul style="list-style-type: none"> <li>• Drink no more than 1 drink per day for women or 2 per day for men.</li> </ul>
<p><b>ACS RECOMMENDATIONS FOR COMMUNITY ACTION</b></p>
<p><b>Public, private, and community organizations should work together at national, state, and local levels to apply policy and environmental changes that:</b></p>
<ul style="list-style-type: none"> <li>• Increase access to affordable, healthy foods in communities, places of work, and schools, and decrease access to and marketing of foods and drinks of low nutritional value, particularly to youth.</li> </ul>

- Provide safe, enjoyable, and accessible environments for physical activity in schools and workplaces, and for transportation and recreation in communities.

## **ACS Guidelines for Nutrition and Physical Activity**

About 2 out of 3 Americans are overweight or obese. Many Americans are also less physically active than they should be. Obesity increases the risk of many types of cancer. It also increases the risk of heart disease, stroke, diabetes, and other health outcomes, such as dying at an early age.

While it is not clear exactly how excess body fat, consuming too many calories, and lack of physical activity raise cancer risk, there is no question that they are linked to an increased risk of many types of cancer and that they are a serious and growing health problem.

### **Achieve and maintain a healthy weight throughout life**

- Be as lean as possible throughout life without being underweight.
- Avoid excess weight gain at all ages. For those who are overweight or obese, losing even a small amount of weight has health benefits and is a good place to start.
- Get regular physical activity and limit intake of high-calorie foods and drinks as keys to help maintain a healthy weight.

### **Body weight and cancer risk**

In the United States, excess body weight is thought to contribute to as many as 1 out of 5 of all cancer-related deaths. Being overweight or obese is clearly linked with an increased risk of several types of cancer:

- Breast (among women who have gone through menopause)
- Colon and rectum
- Endometrium (lining of the uterus)
- Esophagus
- Kidney
- Pancreas

Being overweight or obese also likely raises the risk of other cancers:

- Gallbladder

- Liver
- Non-Hodgkin lymphoma
- Multiple myeloma
- Cervix
- Ovary
- Aggressive forms of prostate cancer

In addition, having too much belly fat is linked with an increased risk of colorectal cancer, and is probably linked to a higher risk of cancers of the pancreas, endometrium (lining of the uterus), and breast cancer (in women past menopause).

Some studies have shown a link between weight loss and a lower risk of breast cancer after menopause. The risk of some other cancers may also be lowered by weight loss. While there is still much to be learned about this area, people who are overweight or obese are encouraged to lose weight.

## **Getting to and maintaining a healthy weight**

A healthy weight depends on a person's height, so recommendations for a healthy weight are often expressed in terms of body mass index (BMI). BMI is a number that is calculated using your weight and height. In general, the higher the number, the more body fat a person has (although there are exceptions).

BMI is often used as a screening tool to help decide if your weight might be putting you at risk for health problems, such as heart disease, diabetes, and cancer. People should strive to maintain a healthy weight, as seen in the table below.

For most adults, experts consider a BMI within the range of 18.5 to 24.9 to be healthy, a BMI between 25 and 29.9 to be overweight, and a BMI of 30 and over to be obese.

BMI	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
Height	Weight in Pounds																
4'10"	91	96	100	105	110	115	119	124	129	134	138	143	148	153	158	162	167
4'11"	94	99	104	109	114	119	124	128	133	138	143	148	153	158	163	168	173
5'	97	102	107	112	118	123	128	133	138	143	148	153	158	163	168	174	179
5'1"	100	106	111	116	122	127	132	137	143	148	153	158	164	169	174	180	185
5'2"	104	109	115	120	126	131	136	142	147	153	158	164	169	175	180	186	191
5'3"	107	113	118	124	130	135	141	146	152	158	163	169	175	180	186	191	197
5'4"	110	116	122	128	134	140	145	151	157	163	169	174	180	186	192	197	204
5'5"	114	120	126	132	138	144	150	156	162	168	174	180	186	192	198	204	210
5'6"	118	124	130	136	142	148	155	161	167	173	179	186	192	198	204	210	216
5'7"	121	127	134	140	146	153	159	166	172	178	185	191	198	204	211	217	223
5'8"	125	131	138	144	151	158	164	171	177	184	190	197	203	210	216	223	230
5'9"	128	135	142	149	155	162	169	176	182	189	196	203	209	216	223	230	236
5'10"	132	139	146	153	160	167	174	181	188	195	202	209	216	222	229	236	243
5'11"	136	143	150	157	165	172	179	186	193	200	208	215	222	229	236	243	250
6'	140	147	154	162	169	177	184	191	199	206	213	221	228	235	242	250	258
6'1"	144	151	159	166	174	182	189	197	204	212	219	227	235	242	250	257	265
6'2"	148	155	163	171	179	186	194	202	210	218	225	233	241	249	256	264	272
6'3"	152	160	168	176	184	192	200	208	216	224	232	240	248	256	264	272	279
	Healthy Weight						Overweight					Obese					

Source: US Department of Health and Human Services, National Institutes of Health, National Health, Lung, and Blood Institute. The Clinical Guidelines on the Identification, Evaluation and Treatment of Overweight and Obesity in Adults: Evidence Report. September 1998 [NIH pub. No. 98-4083].

The way to achieve a healthy body weight is to balance energy intake (what you eat and drink) with energy use (physical activity). Excess body fat can be reduced by lowering the number of calories you consume and increasing your physical activity.

You can lower the number of calories that you take in by eating smaller amounts of food (lowering portion sizes), limiting between-meal snacks, and limiting foods and drinks that are high in calories, fat, and/or added sugars, and that provide few nutrients. Fried foods, cookies, cakes, candy, ice cream, and regular soft drinks should be replaced with vegetables and fruits, whole grains, beans, and lower calorie beverages.

## Be physically active

- Adults should get at least 150 minutes of moderate intensity or 75 minutes of vigorous intensity activity each week (or a combination of these), preferably spread throughout the week.
- Children and teens should get at least 1 hour of moderate or vigorous intensity activity each day, with vigorous activity on at least 3 days each week.
- Limit sedentary behavior such as sitting, lying down, watching TV, and other forms of screen-based entertainment.
- Doing some physical activity above usual activities, no matter what one's level of activity, can have many health benefits.

## Benefits of physical activity

Physical activity may reduce the risk of several types of cancer:

- Breast
- Colon
- Endometrium (lining of the uterus)
- Prostate (advanced cancers)

The risk of other cancers may be lowered as well, although the evidence is limited.

A physically active lifestyle may also lower a person's risk of other health problems such as heart disease, high blood pressure, diabetes, and osteoporosis (bone thinning).

Being active may also help to prevent weight gain and obesity, which may in turn reduce the risk of developing cancers that have been linked to excess body weight.

## Types of activity

*Usual activities* are those that are done on a regular basis as part of one's daily routine. These activities include those done at work (such as walking from the parking garage to the office), at home (such as climbing a flight of stairs), and those that are part of daily living (such as dressing and bathing). Usual activities are typically brief and of low intensity.

*Intentional activities* are those that are done in addition to these usual activities. These activities are often planned and done at leisure, as regularly scheduled physical activity or fitness sessions (exercise), such as a bike ride or a run. Other intentional activities may involve adding more purposeful physical activity into the day and making lifestyle choices to add to or replace other routine activities, such as walking to use public transportation or commuting by bicycle instead of driving.

Usual and intentional activities can also be grouped by intensity:

- *Light* intensity activities include activities such as housework, shopping, or gardening.
- *Moderate* intensity activities are those that require effort equal to a brisk walk.
- *Vigorous* intensity activities generally use large muscle groups and result in a faster heart rate, deeper and faster breathing, and sweating.

## Examples of moderate and vigorous intensity physical activities

	<b>Moderate intensity</b>	<b>Vigorous intensity</b>
<b>Exercise and leisure</b>	Walking, dancing, leisurely bicycling, ice and roller skating, horseback riding, canoeing, yoga	Jogging or running, fast bicycling, circuit weight training, aerobic dance, martial arts,

		jumping rope, swimming
<b>Sports</b>	Volleyball, golfing, softball, baseball, badminton, doubles tennis, downhill skiing	Soccer, field or ice hockey, lacrosse, singles tennis, racquetball, basketball, cross-country skiing
<b>Home activities</b>	Mowing the lawn, general yard and garden maintenance	Digging, carrying and hauling, masonry, carpentry
<b>Workplace activity</b>	Walking and lifting as part of the job (custodial work, farming, auto or machine repair)	Heavy manual labor (forestry, construction, fire fighting)

## Recommended amount of activity

Adults should get at least 150 minutes per week of moderate intensity activity or 75 minutes per week of vigorous intensity activity, or an equal combination, in addition to normal activities of daily living.

When combining different types of activity, 1 minute of vigorous activity can take the place of 2 minutes of moderate activity. For example, 150 minutes of moderate activity, 75 minutes of vigorous activity, and a combination of 100 minutes of moderate activity plus 25 minutes of vigorous activity all count as the same amount.

This level of activity has been shown to have clear health benefits, including lowering the risk of dying at an early age and lowering the chance of getting or dying from certain types of cancer. Higher amounts of physical activity may be even better for lowering cancer risk.

It is not clear if daily activity provides the most benefit if done all at once or in smaller blocks of time throughout the day, but it is reasonable to get your activity in separate sessions of at least 20 to 30 minutes each.

For people who are not active or just starting a physical activity program, activity levels below the recommended levels can still help your health, especially your heart. The amount and intensity of activity can then be increased slowly over time. Most children and young adults can safely do moderate and/or vigorous activities without checking with their doctors. But men older than 40 years, women older than 50 years, and people with chronic illnesses or risk factors for heart disease should check with their doctors before starting a vigorous activity program.

Children and teens should be encouraged to be active at moderate to vigorous intensities for at least an hour a day, every day. Activities should be age appropriate, enjoyable, and varied, including sports and fitness activities in school, at home, and in the community. To help reach activity goals, daily physical education programs and activity breaks should be provided for children at school, and "screen time" (TV viewing, playing video games, or social networking on the computer and similar activities) should be limited at home.

## Limiting time spent sitting

There is growing evidence that the amount of time spent sitting is important, regardless of your activity level. Sitting time raises the risks of obesity, type 2 diabetes, heart disease, and some types of cancer, as well as of dying at a younger age.

Lifestyle changes and advances in technology have led to people being less active and spending more time sitting each day. This is true both in the workplace and at home, due to increased TV, computer, and other screen time. Limiting the amount of time spent sitting, as suggested in the table below, may help maintain a healthy body weight and reduce the risk of certain cancers.

### Tips to reduce sitting time

• Limit time spent watching TV and using other forms of screen-based entertainment.
• Use a stationary bicycle or treadmill when you do watch TV.
• Use stairs rather than an elevator.
• If you can, walk or bike to your destination.
• Exercise at lunch with your coworkers, family, or friends.
• Take an exercise break at work to stretch or take a quick walk.
• Walk to visit coworkers instead of phoning or sending an e-mail.
• Go dancing with your spouse or friends.
• Plan active vacations rather than only driving trips.
• Wear a pedometer every day and increase your number of daily steps.
• Join a sports team.

## Eat a healthy diet, with an emphasis on plant foods

**Choose foods and drinks in amounts that help you get to and maintain a healthy weight.**

- Read food labels to become more aware of portion sizes and calories. Be aware that "low-fat" or "non-fat" does not necessarily mean "low-calorie."
- Eat smaller portions when eating high-calorie foods.

- Choose vegetables, whole fruit, and other low-calorie foods instead of calorie-dense foods such as French fries, potato and other chips, ice cream, donuts, and other sweets.
- Limit your intake of sugar-sweetened beverages such as soft drinks, sports drinks, and fruit-flavored drinks.
- When you eat away from home, be especially mindful to choose food low in calories, fat, and added sugar, and avoid eating large portion sizes.

**Limit how much processed meat and red meat you eat.**

- Limit your intake of processed meats such as bacon, sausage, lunch meats, and hot dogs.
- Choose fish, poultry, or beans instead of red meat (beef, pork, and lamb).
- If you eat red meat, choose lean cuts and eat smaller portions.
- Prepare meat, poultry, and fish by baking, broiling, or poaching rather than by frying or charbroiling.

**Eat at least 2½ cups of vegetables and fruits each day.**

- Include vegetables and fruits at every meal and for snacks.
- Eat a variety of vegetables and fruits each day.
- Emphasize whole fruits and vegetables; choose 100% juice if you drink vegetable or fruit juices.
- Limit your use of creamy sauces, dressings, and dips with fruits and vegetables.

**Choose whole grains instead of refined grain products.**

- Choose whole-grain breads, pasta, and cereals (such as barley and oats) instead of breads, cereals, and pasta made from refined grains, and brown rice instead of white rice.
- Limit your intake of refined carbohydrate foods, including pastries, candy, sugar-sweetened breakfast cereals, and other high-sugar foods.

Studies showing that higher vegetable and fruit intake reduces cancer risk have led researchers to try to figure out which specific nutrients from these foods are responsible. But many studies have not found that supplements containing certain nutrients (like vitamins) reduce cancer risk, and some have even suggested they may cause harm. This is complicated because researchers must try to choose how best to give the supplement, including the exact dose, what group of people to give it to, and how long to give it for, which isn't always known.

Studies of nutritional supplements to reduce cancer risk have not all been disappointing, but for the most part, research does not support their use in lowering cancer risk.

Foods and nutrients probably each have small effects on health that add up when consumed together, and they may interact in complex ways that are not well understood. The best advice at this time is to eat whole foods as part of an overall healthy diet as outlined in this guideline, with special emphasis on controlling calorie intake to help get to and maintain a healthy weight.

## If you drink alcohol, limit your intake

People who drink alcohol should limit their intake to no more than 2 drinks per day for men and 1 drink per day for women. The recommended limit is lower for women because of their smaller body size and slower breakdown of alcohol.

A drink of alcohol is defined as 12 ounces of beer, 5 ounces of wine, or 1½ ounces of 80-proof distilled spirits (hard liquor). In terms of cancer risk, it is the amount of alcohol consumed that is important, not the type of alcoholic drink.

These daily limits do not mean you can drink larger amounts on fewer days of the week, since this can lead to health, social, and other problems.

Alcohol is a known cause of cancers of the:

- Mouth
- Throat (pharynx)
- Voice box (larynx)
- Esophagus
- Liver
- Colon and rectum
- Breast

Alcohol may also increase the risk of cancer of the pancreas.

Alcohol also interacts with tobacco use to increase the risk of cancers of the mouth, larynx, and esophagus many times more than the effect of either drinking or smoking alone.

The recommendation for limiting alcohol is complicated because low to moderate alcohol intake has been linked with a lower risk of heart disease. Despite the effects on the heart, the American Heart Association states that there is no compelling reason for adults who do not drink alcohol to start drinking in order to reduce their risk of heart disease, because the risk can be lowered by other means (such as avoiding smoking, eating a healthy diet, staying at a healthy weight, and staying physically active).

Some groups of people should not drink alcohol at all. These include:

- Children and teens

- People of any age who cannot limit their drinking or who have a family history of alcoholism
- Women who are or may become pregnant
- People who plan to drive or operate machinery
- People who take part in other activities that require attention, skill, or coordination
- People taking prescription or over-the-counter medicines that interact with alcohol

## Recommendations for community action

Although many Americans would like to adopt a healthy lifestyle, many encounter barriers that make it hard to do so. These guidelines therefore stress the importance of public, private, and community organizations working together at national, state, and local levels to apply policy and environmental changes that:

- Increase access to affordable, healthy foods in communities, places of work, and schools, and decrease access to and marketing of foods and drinks of low nutritional value, particularly to youth.
- Provide safe, enjoyable, and accessible environments for physical activity in schools and workplaces, and for transportation and recreation in communities.

## Food additives, safety, and organic foods

The previous sections point to food choices that might lower a person's risk of cancer. Many people are also interested in other aspects of food intake and their potential impact on cancer risk.

### Food additives and contaminants

Many substances are added to foods to prolong shelf and storage life and to enhance color, flavor, and texture. The possible role of food additives in cancer risk is an area of great public interest.

New food additives must be cleared by the US Food and Drug Administration (FDA) before being allowed into the food supply, and thorough testing is done in lab animals to determine any effects on cancer as part of this process. Additives are usually present in very small quantities in food, and some are nutrients that may have beneficial effects (for example, vitamins C and E are sometimes added to food products as a preservative).

Other compounds find their way into the food supply through agricultural use, animal farming, or food processing, even if their use is not directly intended for human consumption. Examples include growth hormones or antibiotics used in animal farming, small amounts of pesticides and herbicides in plant-based foods, and compounds such as bisphenol A (BPA) or phthalates that enter food from packaging. Some of these

compounds are not known to directly cause cancer, but they may influence cancer risk in other ways – for example, by acting as hormone-like substances in the body.

Unintended contamination of food may also result in exposure to chemicals that are a cause of concern and may be related to cancer risk. Examples include heavy metals such as cadmium or mercury. These metals may enter the food supply if they build up the food chain, such as from fish, or they may enter through contamination or their natural presence in soil or water.

For many other compounds for which the effects on cancer risk are not clear, there may be other good reasons to limit exposure. But at the levels that these are found in the food supply, lowering cancer risk is unlikely to be a major reason to justify this.

## **Food processing**

Food processing may also alter foods in ways that might affect cancer risk. An example is the refining of grains, which greatly lowers the amount of fiber and other compounds that may reduce cancer risk.

The processing of meat, by adding preservatives such as salt or sodium nitrite to prevent the growth of germs, or smoking the meat to preserve or enhance color and flavor, may add compounds that might increase the potential of these foods to cause cancer. Studies have linked eating large amounts of processed meats with an increased risk of colorectal cancer. This may be due to nitrites, which are added to many lunch meats, hams, hot dogs, and other processed meats.

Some food processing, such as freezing and canning vegetables and fruits, can preserve vitamins and other components that may decrease cancer risk. Cooking or heat-treating (such as when canning) vegetables breaks down the plant cell walls and may allow the helpful compounds in these foods to be more easily digested. But some of these methods may also lower the content of some heat-sensitive vitamins, such as vitamin C and some B vitamins.

## **Irradiated foods**

Irradiation of food products is one way to limit the risk of germ contamination and food poisoning. In the United States, some foods, such as spices, are routinely irradiated. Irradiated meats and other foods are also widely available. Because radiation is known to cause cancer, there has been concern that food irradiation may present a cancer risk. However, radiation does not remain in foods that have been irradiated.

## **Organic foods**

Concern about the possible effects of food additives on health, including cancer, is one reason that many people are now interested in organic foods. Organic foods are often promoted as an alternative to foods grown with conventional methods that use chemical pesticides and herbicides, hormones, or antibiotics. These compounds cannot be used for foods labeled as "organic." Organic foods, as defined by the US Department of

Agriculture (USDA), also exclude genetically modified foods or foods that have been irradiated.

Whether organic foods carry a lower risk of cancer because they are less likely to be contaminated by compounds that might cause cancer is largely unknown.

Several studies have looked at the nutrient content of organic versus conventionally grown fruits or vegetables, and while some studies suggest a higher nutrient content, others suggest no difference. It is not known if the nutritional differences that have been reported would result in health benefits such as a reduced cancer risk.

Vegetables, fruits, and whole grains should form the central part of a person's diet, regardless of whether they are grown conventionally or organically.

## **Diet and activity factors that affect risks for certain cancers**

### **Bladder cancer**

The major risk factors for bladder cancer are smoking and exposure to certain industrial chemicals. Recent studies have suggested that eating large amounts of chargrilled meats may also raise bladder cancer risk.

Some research suggests that drinking more fluids and eating more vegetables may lower the risk of bladder cancer.

### **Breast cancer**

The risk of breast cancer in women is increased by several factors that cannot be easily changed:

- Having your first period before age 12
- Not having children or having your first child after age 30
- Late age at menopause
- Family history of breast cancer

Other well-known risk factors include the use of menopausal hormone therapy and exposure of the breasts to radiation, especially at a young age.

Both increased body weight and weight gain as an adult are linked with a higher risk of breast cancer after menopause. Alcohol also increases risk of breast cancer. Even low levels of alcohol intake have been linked with an increase in risk.

Many studies have shown that moderate to vigorous physical activity is linked with lower breast cancer risk. A diet that is rich in vegetables, fruit, poultry, fish, and low-fat dairy

products has also been linked with a lower risk of breast cancer in some studies. But it is not clear if specific vegetables, fruits, or other foods can lower risk.

Most studies have not found that lowering fat intake has much of an effect on breast cancer risk.

At this time, the best advice about diet and activity to possibly reduce the risk of breast cancer is to:

- Get regular, intentional physical activity.
- Reduce lifetime weight gain by limiting your calories and getting regular physical activity.
- Avoid or limit your alcohol intake.

## **Colorectal cancer**

The risk of colorectal cancer is higher for those with relatives who have had colorectal cancer or polyps. Risk may also be increased by long-term tobacco use and excessive alcohol use. Several studies have found a higher risk of colorectal cancer with increased alcohol intake, especially among men.

Most studies have found that being overweight or obese increases the risk of colorectal cancer in both men and women, but the link seems to be stronger in men. Having more belly fat (that is, a larger waistline) has also been linked to colorectal cancer.

Overall, diets that are high in vegetables, fruits, and whole grains (and low in red and processed meats) have been linked with lower colorectal cancer risk, although it's not exactly clear which factors are important. Many studies have found a link between red meat or processed meat intake and colorectal cancer risk.

Studies show a lower risk of colorectal cancer and polyps with increasing levels of activity. Moderate activity on a regular basis lowers the risk, but vigorous activity may have an even greater benefit.

In recent years, some large studies have suggested that fiber intake, especially from whole grains, may lower colorectal cancer risk. Research in this area is still under way.

Several studies have found that calcium, vitamin D, or a combination of the two may help protect against colorectal cancer. But because of the possible increased risk of prostate cancer in men with high calcium intake, the ACS does not recommend increasing calcium intake specifically to try to lower cancer risk.

At this time, the best advice about diet and activity to possibly reduce the risk of colorectal cancer is to:

- Increase the intensity and amount of physical activity.
- Limit intake of red and processed meats.

- Get the recommended levels of calcium and vitamin D.
- Eat more vegetables and fruits.
- Avoid obesity and weight gain around the midsection.
- Avoid excess alcohol.

It is also very important to follow the ACS guidelines for regular colorectal screening because finding and removing polyps in the colon can help prevent colorectal cancer.

## **Endometrial (uterine) cancer**

There is strong evidence of a link between being overweight or obese and having a higher risk of endometrial cancer (cancer of the lining of the uterus). Some research has also found a link between having more belly fat (that is, a larger waistline) and endometrial cancer. The link to weight is thought to result from the increase in estrogen levels that happens when women are overweight.

Studies have also found a lower endometrial cancer risk with high physical activity levels, although in some studies this has been limited to women who are overweight or who have not yet gone through menopause. Spending more time sitting (regardless of overall activity level) has also been linked with a higher risk.

Vegetable and fiber intake may lower risk, although some studies have not found this. The evidence for red meat, saturated fat, animal fat, and alcohol raising risk is also conflicting among different studies.

At this time, the best advice about diet and activity to possibly lower the risk of endometrial cancer is to get to and stay at a healthy weight and to get regular physical activity.

## **Kidney cancer**

The causes of kidney cancer are not clear, but the best-known risk factors that can be changed are obesity and tobacco smoking. Studies looking for links between specific parts of the diet and kidney cancer have not shown clear results. A small number of studies have found a possible link between physical activity and lowered risk of kidney cancer.

The best advice to possibly lower risk for kidney cancer is to stay at a healthy weight and avoid tobacco use.

## **Lung cancer**

More than 85% of lung cancers result from tobacco smoking, but other factors, such as radon exposure, are also linked to lung cancer.

Many studies have shown that the risk of lung cancer is lower among both smokers and non-smokers who eat at least 5 servings of vegetables and fruits a day. Although

healthful eating may reduce the risk of lung cancer, the risks from tobacco remain high. Using high-dose beta-carotene and/or vitamin A supplements has been shown to increase (not decrease) lung cancer risk among smokers (see the entry for beta-carotene under the section, "Common questions about diet and cancer").

The best advice to reduce the risk of lung cancer is to avoid tobacco use and secondhand smoke and to avoid radon exposure.

## **Mouth, throat, and esophagus cancers**

Tobacco (including cigarettes, chewing tobacco, and snuff), alcohol, and especially the combination of the two, increase the risk for cancers of the mouth, larynx (voice box), pharynx (throat), and esophagus.

Obesity raises the risk for cancer in the lower esophagus and at the junction of the esophagus and stomach (likely due to increased acid reflux). Very hot beverages and foods may also increase the risk of mouth and esophagus cancers, likely as a result of the damage heat can cause.

A diet high in vegetables and fruits may reduce the risk of mouth and esophagus cancers.

The best advice to possibly reduce the risk of these cancers is to:

- Avoid all forms of tobacco.
- Restrict alcohol intake.
- Avoid obesity.
- Eat at least 2½ cups of vegetables and fruits each day.

## **Ovarian cancer**

The causes of ovarian cancer are not well understood. Family history is a risk factor, but only about 10% of ovarian cancers are inherited.

There are no clearly proven nutritional risk factors for ovarian cancer. Some studies have found that obesity may increase the risk for ovarian cancer, as may a diet high in fat (especially saturated fat). The role of physical activity in ovarian cancer risk is unclear. Studies of vegetables, fruits, meat, dairy products, and alcohol have not found clear links.

Some studies have found possible role for eating soy foods and drinking tea (especially green tea) in lowering ovarian cancer risk, but not all studies have found this.

At this time, it is not clear how nutrition and physical activity might be related to ovarian cancer risk, so no strong recommendations can be made.

## **Pancreatic cancer**

Tobacco smoking, type 2 diabetes, and impaired glucose tolerance (sometimes called "pre-diabetes," or "borderline diabetes") all increase the risk for pancreatic cancer.

Several studies have found a link between being overweight or obese and having a higher risk of pancreatic cancer. Some research has also found a link between having more belly fat (that is, a larger waistline) and pancreatic cancer, especially in women.

Some studies have suggested that pancreatic cancer risk may be reduced with higher levels of physical activity, especially if it is part of a person's job. On the other hand, diets high in red and processed meats and low in fruits and vegetables have been linked with increased risk in some studies. More research is needed to confirm these findings.

Few studies have looked at possible links between specific foods or alcohol intake and risk of pancreatic cancer.

The best advice to possibly lower the risk of pancreatic cancer is to avoid tobacco use and stay at a healthy weight. Being physically active and following the other ACS recommendations related to a healthy diet may also be helpful.

## **Prostate cancer**

Prostate cancer is related to age, family history, and male sex hormones, but just how diet and activity factors might affect risk is not clear.

In recent years, researchers have learned it may be important to distinguish between prostate cancers that are aggressive (likely to grow and spread quickly) and those that are less likely to cause problems.

For example, some studies have found that men who are overweight may have a lower risk of prostate cancer overall, but a higher risk of prostate cancers that are likely to be fatal. Being overweight is also linked with a worse outlook in men who have been diagnosed and treated for prostate cancer.

Studies have found that men who get regular physical activity have a slightly lower risk of prostate cancer. Vigorous activity may have a greater effect, especially on the risk of advanced prostate cancer.

Several studies suggest that diets high in certain vegetables (including tomatoes, cruciferous vegetables, soy, beans, and other legumes) or fish may be linked with a lower risk of prostate cancer, especially more advanced cancers. Examples of cruciferous vegetables include broccoli, cauliflower, and cabbage.

Studies so far have not found a benefit from taking supplements containing antioxidant nutrients, such as vitamin E or selenium. In fact, a recent large study found that vitamin E supplements might actually raise prostate cancer risk slightly.

Several studies have found that diets high in calcium may raise prostate cancer risk. Dairy foods may also increase risk.

For now, the best advice about diet and activity to possibly reduce the risk of prostate cancer is to:

- Eat at least 2½ cups of a wide variety of vegetables and fruits each day.
- Be physically active.
- Stay at a healthy weight.

It may also be sensible to limit calcium supplements and to not get too much calcium in the diet. But because calcium and dairy intake may lower the risk of colorectal cancer, the ACS does not have specific recommendations on calcium and dairy food intake to try to lower cancer risk.

## **Stomach cancer**

The number of stomach cancer cases in most parts of the world is falling. While stomach cancer is fairly rare in the United States, the rate of cancers in the first part of the stomach (the cardia) has risen in recent years. This may be due at least in part to increases in gastric reflux, which has been linked to obesity.

Many studies have found that a high intake of fresh fruits and vegetables is linked with a lower risk of stomach cancer, while a high intake of salt, salt-preserved foods, and possibly processed meat, is linked with a higher risk.

Not many studies have looked at the possible effects of body size or obesity on stomach cancer, but most have found an increased risk with higher body weight. There are also few studies that have looked at the effects of physical activity on stomach cancer, but it seems to be linked with a lower risk.

At this time, the best advice to possibly reduce the risk of stomach cancer is to:

- Eat at least 2½ cups of vegetables and fruits daily.
- Reduce intake of processed meat, salt, and foods preserved with salt.
- Be physically active.
- Stay at a healthy weight.

## **Common questions about diet and cancer**

Because people are interested in the possible links between specific foods, nutrients, or lifestyle factors and specific cancers, research on health behaviors and cancer risk is often reported in the news. No one study, however, provides the last word on any subject, and single news reports may put too much emphasis on what appear to be conflicting results. In brief news stories, reporters cannot always put new research findings in their proper context. Therefore, it is rarely, if ever, a good idea to change diet or activity levels based on a single study or news report. The following questions and answers address common concerns about diet and physical activity in relation to cancer.

## Alcohol

**Does alcohol increase cancer risk?** Yes. Alcohol raises the risk of cancers of the mouth, pharynx (throat), larynx (voice box), esophagus, liver, breast, and the colon and rectum. People who drink alcohol should limit their intake to no more than 2 drinks per day for men and 1 drink per day for women. A drink is defined as 12 ounces of beer, 5 ounces of wine, or 1½ ounces of 80-proof distilled spirits (hard liquor). The combination of alcohol and tobacco increases the risk of some cancers far more than the effect of either drinking or smoking alone. Regular intake of even a few drinks per week is linked to a higher risk of breast cancer in women. Women at high risk of breast cancer may want to consider not drinking any alcohol.

## Antioxidants

**What are antioxidants, and what do they have to do with cancer?** The body uses certain compounds in foods and chemicals made in the body, called antioxidants, to help protect against damage to tissues that happens constantly as a result of normal metabolism (oxidation). Because such damage is linked with increased cancer risk, some antioxidants may help protect against cancer. Antioxidants include vitamin C, vitamin E, carotenoids (such as beta-carotene and vitamin A), and many other phytochemicals (chemicals from plants). Studies suggest that people who eat more vegetables and fruits, which are rich sources of antioxidants, may have a lower risk for some types of cancer. But this does not necessarily mean that it is the antioxidants that are responsible for this, as these foods also contain many other compounds.

Several studies of antioxidant supplements have not found that they lower cancer risk. In fact, some studies have found an increased risk of cancer among those taking supplements. (See also entries for: beta-carotene, lycopene, vitamin E, supplements). To reduce cancer risk, the best advice at this time is to get your antioxidants through food sources rather than supplements.

## Beta-carotene

**Does beta-carotene reduce cancer risk?** Beta-carotene belongs to a group of antioxidants called carotenoids, which give some parts of plants (including vegetables and fruits) their deep orange color. In the body, beta-carotene is converted to vitamin A, which is thought to help prevent cancer. Because eating vegetables and fruits is linked with a reduced risk of cancer, it seemed to make sense that taking high doses of beta-carotene supplements might reduce cancer risk. But the results of several major studies show this is not the case. In 2 studies in which people were given high doses of beta-carotene supplements to try to prevent lung and other cancers in smokers, the supplements were found to *increase* the risk of lung cancer, and a third study found neither benefit nor harm from them. Eating vegetables and fruits that contain beta-carotene may be helpful, but high-dose beta-carotene supplements should be avoided, especially by smokers.

## Calcium

**Is calcium related to cancer?** Several studies have suggested that foods high in calcium might help reduce the risk of colorectal cancer, and calcium supplements modestly reduce the recurrence of colorectal polyps. But a high calcium intake, whether through supplements or food, has also been linked with an increased risk of prostate cancer.

In light of this, men should try to get – but not exceed – recommended levels of calcium, mainly through food sources. As women are not at risk of prostate cancer and are at a higher risk of osteoporosis (bone thinning), they should try to get recommended levels of calcium mainly through food sources. Recommended levels of calcium are 1000 mg/day for people ages 19 to 50 years and 1200 mg/day for people aged older than 50. Dairy products are excellent sources of calcium, as are some leafy vegetables and greens. People who get a lot of their calcium from dairy products should select low-fat or non-fat choices to reduce their intake of saturated fat.

## Coffee

**Does drinking coffee cause cancer?** No. The possible link between coffee and cancer of the pancreas, which got a lot of attention in the past, has not been confirmed by recent studies. At this time, there is no evidence that coffee or caffeine increases the risk of cancer.

## Dietary supplements

**Can dietary supplements lower cancer risk?** No, at least based on what we know at this time. A diet rich in vegetables, fruits, and other plant-based foods may reduce the risk of cancer, but there is little proof that dietary supplements can reduce cancer risk. One exception may be calcium supplements, which may reduce the risk of colorectal cancer (see the entry for calcium above). Some high-dose supplements may actually increase cancer risk.

Some dietary supplements may be beneficial for other reasons for some people, such as pregnant women, women of childbearing age, and people with restricted dietary intakes. If a person chooses to take a dietary supplement, the best choice is a balanced multivitamin/mineral supplement containing no more than 100% of the "daily value" of most nutrients.

**Can I get the nutritional equivalent of vegetables and fruits in a pill?** No. Many healthful compounds are found in vegetables and fruits, and these compounds most likely work together to produce their helpful effects. There are also likely to be important compounds in whole foods that are not yet known and therefore are not included in supplements. Some supplements are described as containing the nutritional equivalent of vegetables and fruits. But the small amount of dried powder in such pills often contains only a small fraction of the levels contained in the whole foods. Food is the best source of vitamins and minerals.

## **Fat**

**Will eating less fat lower cancer risk?** Some studies have found that people who live in countries with higher amounts of fat in their diet have higher rates of breast, prostate, colon, and other cancers. But more thorough studies have not found that fat intake increases cancer risk, or that lowering fat intake reduces cancer risk. At this time, there is not much proof that the total amount of fat a person eats affects cancer risk.

## **Fiber**

**What is dietary fiber, and can it lower cancer risk?** Dietary fiber includes a wide variety of plant carbohydrates that humans cannot digest. Good sources of fiber are dried beans, vegetables, whole grains, and fruits. Specific categories of fiber are "soluble" (such as oat bran, peas, beans, and psyllium fiber) or "insoluble" (such as wheat bran, fruit peels and skins, nuts, seeds, and cellulose).

Recent studies suggest dietary fiber is linked with a lower risk of some types of cancer, especially colorectal cancer. But it is not clear whether it is the fiber or another component of high-fiber foods that is responsible for the link. These findings are one of the reasons that the ACS recommends eating high-fiber foods such as whole grains, vegetables, and fruits to help reduce cancer risk, but does not expressly recommend the use of fiber supplements.

## **Fish**

**Does eating fish protect against cancer?** Fish is a rich source of omega-3 fatty acids. Studies in animals have found that these fatty acids may stop cancer from forming or slow its growth, but it is not clear if they can affect cancer risk in humans.

Eating fish rich in omega-3 fatty acids is linked with a reduced risk of heart disease, but some types of fish (such as swordfish, tuna, tilefish, shark, and king mackerel) may contain high levels of mercury, polychlorinated biphenyls (PCBs), dioxins, and other pollutants. Some studies have also shown that farm-raised fish may carry more of these harmful substances than fish caught in the wild. Women who are pregnant, planning to become pregnant, or breast-feeding, and young children should not eat these fish, and should limit eating albacore tuna to no more than 6 ounces a week and canned light tuna to no more than 12 ounces a week. People should vary the types of fish they eat to reduce the chance of exposure to toxins.

## **Folate and folic acid**

**What are folate and folic acid, and can they lower cancer risk?** Folate is a B vitamin naturally found in many vegetables, beans, fruits, whole grains, and fortified breakfast cereals. Some studies from the 1990s suggested that a lack of folate might increase the risk of colorectal and breast cancers, especially in people who drink alcohol. But since 1998, enriched grain products in the United States have been fortified with folic acid, a manmade form of this vitamin, so most people get enough folate in their diet.

Some studies suggest that folic acid supplements may increase the risk of prostate cancer, advanced colorectal polyps, and possibly breast cancer. Because of this, and the fact that most people get enough folate in their diet, the best way to get folate is by eating vegetables, fruits, and enriched or whole-grain products.

## **Garlic**

**Can garlic lower cancer risk?** Claims of the health benefits of the *Allium* compounds found in garlic and other vegetables in the onion family have been publicized widely. Garlic is now being studied to see if it can reduce cancer risk, and a few studies suggest that it may reduce the risk of colorectal cancer. Garlic and other foods in the onion family may be included in the variety of vegetables that are recommended for lowering cancer risk.

At this time there is not much evidence that *Allium* compound supplements can lower cancer risk.

## **Genetically modified foods**

**What are genetically modified foods, and are they safe?** Genetically modified or bioengineered foods are made by adding genes from other plants or organisms to increase a plant's resistance to insects; slow spoilage; or improve flavor, nutrient content, or other desired qualities. In recent years, there has been growing use of genetic engineering to produce certain foods. In the United States, for example, most soybeans and corn are grown from seeds that have been modified to resist herbicides, and in the case of corn, to make a natural insecticide.

Concerns have been raised about the safety of using genetically modified seeds. In theory, these added genes might create substances that could cause allergic reactions in some people, or could result in higher levels of compounds that cause health effects. On the other hand, genetic modification might also be used to improve public health. For example, there is interest in increasing the folate content of various plant foods through genetic modification.

There is no proof at this time that the genetically modified foods that are now on the market are harmful to human health or that they would either increase or decrease cancer risk because of the added genes. But the lack of proof of harm is not the same as proof of safety, and because these foods have been around for a fairly short time, the possible long-term health effects are not known. It is important that the safety of genetically modified foods continues to be assessed to be sure of their genuine safety as well as to increase confidence that their use is worthwhile.

Examples of genetically modified foods approved for sale in the United States include varieties of carrots, corn, tomatoes, and soy. The US Environmental Protection Agency (EPA), US Food and Drug Administration (FDA), and the US Department of Agriculture (USDA) all share oversight of these foods.

## **Irradiated foods**

**Do irradiated foods cause cancer?** There is no proof that irradiation of foods causes cancer or has harmful human health effects. Radiation is increasingly used to kill harmful germs on foods to extend their shelf life. Radiation does not stay in the foods after treatment, and eating irradiated foods does not appear to increase cancer risk.

## **Meat: Cooking and preserving**

**Should I avoid processed meats?** Some studies have linked eating large amounts of processed meat to increased risk of colorectal and stomach cancers. This link may be due in part to nitrites, which are added to many lunch meats, hams, and hot dogs to maintain color and to prevent bacterial growth. Eating processed meats and meats preserved using smoke or salt increases exposure to potential cancer-causing agents and should be reduced as much as possible.

**How does cooking meat affect cancer risk?** Adequate cooking is needed to kill harmful germs in meat. But some research suggests that frying, broiling, or grilling meats at very high temperatures forms chemicals (polycyclic aromatic hydrocarbons or heterocyclic aromatic amines) that might increase cancer risk. These chemicals can damage DNA and cause cancer in animals, but it is not clear how much they (as opposed to other substances in meat) may contribute to the increased colorectal cancer risk seen in people who eat large amounts of meat in some studies. Techniques such as braising, steaming, poaching, stewing, and microwaving meats produce fewer of these chemicals.

## **Non-nutritive sweeteners and sugar substitutes**

**Do non-nutritive sweeteners or sugar substitutes cause cancer?** There is no proof that these sweeteners, at the levels consumed in human diets, cause cancer. Aspartame, saccharin, and sucralose are a few of the non-nutritive sweeteners approved for use by the FDA. Current evidence does not show a link between these compounds and increased cancer risk. Some animal studies have suggested that their use may be linked with an increased risk of cancers of the bladder and brain, or of leukemias and lymphomas, but studies in humans show no increased cancer risk. People with the genetic disorder phenylketonuria, however, should avoid aspartame in their diets.

Newer sugar substitutes include sweeteners such as sugar alcohols (sorbitol, xylitol, and mannitol) and naturally derived sweeteners (stevia and agave syrup). All of these sweeteners appear to be safe when used in moderation, although larger amounts of sugar alcohols may cause bloating and stomach discomfort in some people.

## **Obesity**

**Does being overweight increase cancer risk?** Yes. Being overweight or obese is linked with an increased risk of cancers of the breast (among women after menopause), colon and rectum, endometrium, esophagus, kidney, and pancreas, and probably cancer of the gallbladder as well. It may also be linked with increased risk of cancers of the liver,

cervix, and ovary, as well as non-Hodgkin lymphoma, multiple myeloma, and aggressive forms of prostate cancer.

Research on whether losing weight reduces cancer risk is limited, but some research suggests that weight loss lowers the risk of breast cancer in women past menopause and possibly other cancers. Because of other proven health benefits, people who are overweight are encouraged to lose weight and keep it off. Avoiding excess weight gain as an adult is important not only in possibly lowering cancer risk but also in reducing the risk of other chronic diseases.

## **Olive oil**

**Does olive oil affect cancer risk?** Consuming olive oil is linked with a reduced risk of heart disease. It is most likely neutral with respect to cancer risk. Although olive oil, which is rich in monounsaturated fat, is a healthy alternative to butter and margarine, it is still a dense source of calories, and it can add to getting too many calories in the diet.

## **Organic foods**

**Are foods labeled "organic" more effective in lowering cancer risk?** The term "organic" is widely used to describe foods from plants grown without adding artificial chemicals, and foods from animals raised without hormones or antibiotics. Organic plant foods come from farming methods that do not use most conventional pest or weed killers, chemical fertilizers or sewage sludge as fertilizer, or food irradiation in processing. Foods that are genetically modified cannot be called organic.

While the purpose of organic food production is to promote sustainable farming practices, it is widely perceived that eating organic foods may carry health benefits. There is some debate over whether organic produce may have higher nutritional levels than conventionally grown produce. But at this time, there is no evidence that such foods are more effective in reducing cancer risk or providing other health benefits than similar foods produced by other farming methods.

## **Pesticides and herbicides**

**Do pesticides and herbicides in foods cause cancer?** Pesticides and herbicides can be toxic when used improperly in industrial, farming, or other workplace settings. Although vegetables and fruits sometimes contain low levels of these chemicals, overwhelming scientific evidence supports the overall health benefits and cancer-protective effects of eating vegetables and fruits. At this time there is no evidence that residues of pesticides and herbicides at the low doses found in foods increase the risk of cancer. Still, fruits and vegetables should be washed thoroughly before eating, not only to lower exposure to these compounds but also to limit the risk of health effects from germs.

## Physical activity

**Will increasing physical activity lower cancer risk?** Yes. People who get moderate to vigorous levels of physical activity are at a lower risk of developing several cancers, including those of the breast, colon, and endometrium (lining of the uterus), as well as advanced forms of prostate cancer. For some cancers, this risk is lowered whether or not the activity affects the person's weight.

Data for a direct effect on the risk of developing other cancers is more limited. Even so, physical activity is a key factor in reaching and staying at a healthy body weight, and being overweight or obese has been linked with many types of cancer. Physical activity is also helpful in lowering the risk of heart disease, diabetes, and other diseases.

## Phytochemicals

**What are phytochemicals, and do they reduce cancer risk?** The term "phytochemicals" refers to a wide variety of compounds made by plants. Some of these compounds protect plants against insects or have other important functions. Some have either antioxidant or hormone-like actions both in plants and in the people who eat them. Because consuming vegetables and fruits is linked with a reduced risk of cancer, researchers are looking for the specific compounds responsible for the helpful effects. But at this time, no evidence has shown that phytochemicals taken as supplements are as good for your long-term health as the vegetables, fruits, beans, and grains from which they are extracted.

Examples of phytochemicals include flavonoids (found in soy, chickpeas, and tea), carotenoids (found in butternut squash, cantaloupe, and carrots), anthocyanins (found in eggplant and red cabbage), and sulfides (found in garlic and onions).

## Salt

**Do high levels of salt in the diet increase cancer risk?** There is good evidence that diets that contain large amounts of foods preserved by salting and pickling carry an increased risk of stomach, nasopharyngeal, and throat cancer. Such foods generally are not a major part of the diets of most people in the United States, but lowering intake of salt-cured or pickled foods may help lower the risk of some cancers.

There is little evidence to suggest that the levels of salt used in cooking or flavoring foods or added to foods during processing in the United States affect cancer risk. But it is known to raise the risk of high blood pressure and heart disease, so the 2010 Dietary Guidelines for Americans and those of the American Heart Association recommend limiting salt intake.

## Selenium

**What is selenium, and can it reduce cancer risk?** Selenium is a mineral that helps the body's antioxidant defense mechanisms. Animal studies have suggested that selenium

might protect against cancer. One study suggested that selenium supplements might reduce the risk of lung, colon, and prostate cancer in humans. But selenium supplements were not found to lower prostate cancer risk in a large clinical trial, and overall there is no good evidence that selenium supplements can lower cancer risk.

Selenium supplements are therefore not recommended, and high-dose selenium supplements should be avoided because there is only a narrow margin between safe and toxic doses. The maximum dose in a supplement should not exceed 200 micrograms per day.

## **Soy products**

**Can soy-based foods reduce cancer risk?** As with other beans or legumes, soy and foods derived from soy are an excellent source of protein and a good alternative to meat. Soy contains several phytochemicals, including isoflavones, which have weak estrogen-like activity and may help protect against hormone-dependent cancers. There is growing evidence that eating traditional soy foods such as tofu may lower the risk of cancers of the breast, prostate, or endometrium (lining of the uterus), and there is some evidence it may lower the risk of certain other cancers. Whether this applies to foods that contain soy protein isolates or textured vegetable protein derived from soy is not known.

There is little data to support the use of supplements of isolated soy phytochemicals for reducing cancer risk.

## **Sugar**

**Does sugar increase cancer risk?** Sugar increases calorie intake without providing any of the nutrients that reduce cancer risk. By promoting obesity, a high sugar intake may indirectly increase cancer risk. White (refined) sugar is no different from brown (unrefined) sugar or honey with regard to their effects on body weight or insulin levels. Limiting foods such as cakes, candy, cookies, and sweetened cereals, as well as sugar-sweetened drinks such as soda and sports drinks can help reduce calorie intake.

## **Tea**

**Can drinking tea (black or green) reduce cancer risk?** Tea is a drink that results from infusion of the leaves, buds, or twigs of the tea plant (*Camellia sinensis*). Black, green, white, pu-erh, and other varieties of tea all come from the same plant, but reflect the different ways in which they are processed.

Some researchers have proposed that tea might protect against cancer because of its antioxidant, polyphenol, and flavonoid content. In animal studies, some teas (including green tea) have been shown to reduce cancer risk, but findings from studies looking at humans are mixed. The results of lab studies have been promising and tea drinking is a part of many cuisines, but evidence does not support the lowering of cancer risk as a central reason for drinking tea at this time.

## **Trans fats**

**Do trans fats increase cancer risk?** Trans fats are made when vegetable oils are hydrogenated to create oils such as margarine or shortening, which are solid at room temperature. Trans fats raise blood cholesterol levels and increase heart disease risk. But their relationship with cancer risk has not been determined.

Still, the 2010 Dietary Guidelines for Americans and those from the American Heart Association recommend limiting or avoiding trans fats, due to their effect on the risk of heart disease.

## **Turmeric and other spices**

**Do turmeric and other spices reduce cancer risk?** Research is now under way looking at whether turmeric can affect cancer growth. Other spices also being studied for possible anti-cancer effects include capsaicin (red pepper), cumin, and curry. But studies in humans looking at the long-term effects of spices on diseases such as cancer are lacking at this time.

## **Vegetables and fruits**

**Will eating vegetables and fruits lower cancer risk?** Yes. The strength of the evidence that eating vegetables and fruits lowers cancer risk has weakened recently as more studies have found no or only weak effects, but the overall evidence suggests some lowering of risk for several types of cancer. This includes cancers of the lung, mouth, throat (pharynx), voice box (larynx), esophagus, stomach, colon, and rectum.

The types of vegetables and fruits that may reduce the risk of certain cancers may differ. It is not known which of the many compounds in vegetables and fruits are most likely to protect against cancer, and different vegetables and fruits may be rich sources of different phytochemicals that may lower cancer risk.

Recent studies suggest that eating more vegetables and fruits may also help lower the risk of developing obesity, and thus is likely to have an indirect effect on cancer risk. The best advice is to eat at least 2½ cups of a variety of colorful vegetables and fruits each day.

**Is there a difference in the nutritional value of fresh, frozen, and canned vegetables and fruits?** Yes, but they can all be good choices. Fresh foods are usually thought to have the most nutritional value (and often the best flavor as well). But frozen foods can actually be more nutritious than fresh foods because they are often picked ripe and quickly frozen (whereas fresh foods may lose some of their nutrients in the time between harvesting and eating).

Canning is more likely to reduce heat-sensitive and water-soluble nutrients because of the high heat that must be used. Be aware that some fruits are packed in heavy syrup, and some canned vegetables are high in sodium (salt). Choose vegetables and fruits in a variety of forms.

**Does cooking affect the nutritional value of vegetables?** Boiling vegetables, especially for long periods, can remove their water-soluble vitamins. Some potentially beneficial phytochemicals are fat soluble, so sautéing in oil may increase the availability of these compounds. Cooking in general may break down plant cell walls and make nutrients and other phytochemicals more readily absorbed.

Microwaving and steaming are the best ways to preserve the nutritional content of vegetables. Eating raw vegetables, such as in salads, also preserves nutritional content. Along with the general recommendation to eat a wide variety of vegetables, using different cooking methods may also enhance the availability of many nutrients and phytochemicals.

**Should I be juicing my vegetables and fruits?** Juicing can add variety to the diet and can be a good way to get your vegetables and fruits, especially if chewing or swallowing is a problem. Juicing also helps the body absorb some of the nutrients in vegetables and fruits. But juices contain less fiber and may be less filling than whole vegetables and fruits. Fruit juice in particular can account for quite a few calories if a person drinks a lot of it. Commercially juiced products should be 100% vegetable or fruit juices. They should also be pasteurized to kill harmful germs.

## **Vegetarian diets**

**Do vegetarian diets reduce cancer risk?** Vegetarian diets can include many health-promoting features. They tend to be low in saturated fat and high in fiber, vitamins, and phytochemicals, and do not include eating red and processed meats. Thus, it is reasonable to suggest that vegetarian diets may be helpful in lowering cancer risk.

Whether vegetarian diets offer any special benefits against cancer over diets that include smaller amounts of animal products than are typically eaten in Western diets is less clear.

Strict vegetarian diets that avoid all animal products including milk and eggs, referred to as "vegan" diets, can benefit from supplementation with vitamin B12, zinc, and iron, especially for children and women before menopause. These diets should also include enough calcium, as people eating vegan diets with fairly low calcium content have been shown to have a higher risk of bone fractures compared with people eating vegetarian or meat-containing diets.

## **Vitamin A**

**Does vitamin A lower cancer risk?** Vitamin A (retinol) is obtained from foods in 2 ways: it can be taken in as vitamin A from animal food sources, or it can be made in the body from beta-carotene or other carotenoids in plant-based foods. Vitamin A is needed to maintain healthy tissues.

Vitamin A supplements have not been shown to lower cancer risk, and high-dose supplements may, in fact, increase the risk for lung cancer in current and former smokers.

## Vitamin C

**Does vitamin C lower cancer risk?** Vitamin C is found in many vegetables and fruits, especially oranges, grapefruits, and peppers. Many studies have linked intake of foods rich in vitamin C to a lower risk of cancer. But the few studies in which vitamin C has been given as a supplement have not shown a reduced risk for cancer.

## Vitamin D

**Does vitamin D lower cancer risk?** Growing evidence from studies that observe large groups of people suggests that vitamin D may help prevent colorectal cancer, but so far the evidence does not support links to other cancers. Large studies are now under way, but the results will not be ready for several years.

The Institute of Medicine recently increased recommendations for the daily intake of vitamin D, based on levels required for bone health, from 400 to 600 international units (IU) for most adults, and to 800 IU per day for those aged 70 years and older. The upper daily limit of what is considered safe was increased from 2000 IU to 4000 IU.

Vitamin D is obtained through skin exposure to ultraviolet (UV) radiation; through diet, especially products fortified with vitamin D such as milk and cereals; and through supplements. But many Americans do not get enough vitamin D and are at risk of deficiency, especially people with dark skin, those with little sun exposure, the elderly, and exclusively breast-fed babies.

## Vitamin E

**Does vitamin E lower cancer risk?** Alpha-tocopherol is the most active form of vitamin E in humans and is a powerful antioxidant. In one study, male smokers who took alpha-tocopherol had a lower risk of prostate cancer compared with those who took a placebo. This led to a large study (known as SELECT) that looked at the effects of selenium and vitamin E supplements on prostate cancer risk. But the study found that these supplements did not lower the risk of prostate cancer. If anything, the men taking vitamin E supplements may have had an increased risk.

Another large study (known as HOPE) looked at the risk of cancer and heart disease with vitamin E supplements compared with a placebo. No difference was seen in cancer rates or heart disease rates between the vitamin E supplement and placebo groups. Heart failure rates were actually higher among those taking vitamin E supplements.

Vitamin E supplements are not recommended to try to lower the risk of cancer or chronic diseases, although foods containing vitamin E, including nuts and some unsaturated oils, can be healthy and have been shown to lower the risk of heart disease.

Last Revised: 1/11/2012

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