



A GUIDE FOR CANCER PATIENTS ON NUTRITION AND PHYSICAL EXERCISE, BOTH DURING AND AFTER TREATMENT.

This guide has been provided by the Anticancer Fund as a service to patients, to help them and their relatives better understand the importance of nutrition and physical exercise both during and after cancer treatment. We recommend patients ask their doctors which treatments could be useful for their situation. The information described in this document is based on scientific research and is for informative purposes only.

More information about the Anticancer Fund: www.anticancerfund.org

For words marked with an asterisk, a definition is provided at the end of the document.*



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INTRODUCTION

A healthy lifestyle, and more specifically proper nutrition and sufficient exercise, can affect the prognosis for cancer patients.

Numerous studies, particularly observational epidemiological* ones, have already demonstrated the link between nutrition and physical activity and cancer prevention. Based on these studies, specialists at the American Cancer Society (ACS), the World Cancer Research Fund (WCRF) and the American Institute for Cancer Research (AICR) have compiled a set of guidelines. This guide will provide an overview of these guidelines. Cancer survivors are encouraged to follow these guidelines, as there is increasing evidence that they could reduce the chance of relapse and combat the development of new cancers. These guidelines could also reduce the risk of developing complications such as cardiovascular disease, bone diseases, including osteoporosis* and osteopenia*, depression, fatigue, diabetes and other hormonal disorders that result from cancer and its treatment.

The recommendations all emphasise the importance of a healthy body weight, regular physical exercise, a primarily plant-based and fibre-heavy diet that is rich in vegetables, fruit and wholegrain products, no smoking and the limited consumption of alcohol and red and processed meat. It is also recommended that all required nutrients be obtained from your diet and not from dietary supplements.

Much information is spread through the media – the internet in particular – about specific diets that assert they can cure cancer. To date there has been no scientific evidence whatsoever that backs up these promises. Should you wish to follow a certain diet, then discuss it first with your treating doctor or nutritionist.



1. STRIVE FOR A NORMAL BODY WEIGHT

It is best, both during and after cancer treatment, to strive for a normal body weight and try not to gain weight or suffer from extreme weight loss. Nutritional screening (knowing what and how much someone eats) and follow-up are essential at the start of the treatment.

A normal body weight is a BMI (body mass index) of between 18.5 and 24.9 kg/m². BMI is calculated by dividing weight in kilograms by height in meters squared (BMI=kg/m²).

Excess body weight is a recognised risk factor for various types of cancer, such as post-menopausal breast cancer, colon cancer, oesophageal cancer, kidney cancer, gallbladder cancer, endometrial cancer, ovarian cancer, pancreatic cancer and advanced prostate cancer. It is also associated with increased mortality rates among patients with different kinds of cancers, such as breast cancer and endometrial cancer, as the risk of relapse is higher and the overall survival rate is lower.

There are indications that excess weight (BMI between 25 and 30) and obesity (BMI greater than 30) are risk factors for certain secondary cancers, and are also responsible in part for additional diseases, such as cardiovascular diseases and diabetes [link to: [Body Weight and Prognosis in Cancer Survivors](#)].

There are various biological mechanisms that can explain the association between excessive body weight and the risk of cancer, including an increase in insulin* production (which can lead to insulin resistance*), an increase in hormones made by fat cells (such as leptin), growth factors* (such as IGF-1*), oestrogens*, androgens*, and inflammatory factors, etc. For this reason, it is important that cancer patients who are obese or overweight when diagnosed, are encouraged to aim for modest weight loss during their treatment (a maximum of 1 kg a week) through calorie restriction and physical exercise. This should have a positive effect upon the hormone balance and improve quality of life and physical capabilities. It is however important to emphasise intentional and deliberate weight loss, and not unintentional weight loss, as that is linked to lower survival rates (see below). In some cases it would be better to wait until after surgery, radiotherapy* and/or chemotherapy* before trying to lose weight. When following a specific weight loss plan, consult the treating doctor and/or an oncology or general dietician first.

Many cancer patients gain weight as a result of cancer and its treatment. For example, between 50% and 90% of breast cancer patients report weight gain, specifically fat gain, during and after treatment. One of the underlying causes of this is metabolic changes, which result in a change to dietary preferences, as well as the nausea and fatigue associated with the treatment, which means the patient will be less inclined to be physically active and consequently burn fewer calories. It is important that the doctor or oncology or general dietician is informed of this.



Safe weight loss can be achieved by combining a balanced diet with increased physical activity, adapted to individual capabilities and in consultation with the treating doctor and/or oncology or general dietician or nutritionist. According to a recent study, following a specific 5:2 diet led to more weight loss than a daily low-calorie diet. This could be because of the fact that dieting for two days is easier to stick to than a daily diet. The 5:2 diet that was the subject of the study entails limiting one's intake to 800-1000 kcal a day for two successive days, and sticking to a Mediterranean diet for the other five days. A Mediterranean diet consists primarily of vegetables, fruit, nuts, seeds, beans, wholegrain products, olive oil, fish and seafood, poultry, eggs and less than 400 g of lean, red and processed meat a week, with the moderate consumption of dairy products. Observational studies* suggest that the Mediterranean diet can stop some types of cancer developing. Moreover, it has been proven that it protects against the development of cardiovascular and other chronic diseases.

As stated above, it is important to distinguish between intentional weight loss due to following a diet and unintentional weight loss as a result of cancer or cancer treatment, which is thus unplanned.

Unintentional weight changes in the wake of being diagnosed with breast cancer are linked to lower survival rates. In a large-scale study involving 12,195 breast cancer patients, 14.7% of the women had an average weight loss of 1.6 kg. An average weight loss of over 10% was related to a 40% increase in the risk of death. It is important to note that overweight or obese cancer patients can also become undernourished, resulting in unintentional weight loss. That is why it is important that this is monitored, as it can lead to sarcopenic obesity*, with a poor prognosis as a result.

Patients who are underweight, or who unintentionally lose a great deal of weight due to treatment, must increase their body weight through an adjusted diet supervised by the treating doctor and/or oncology or general dietician. Malnutrition, whether at the time a person is diagnosed with cancer or as a result of the treatment, increases the chance of serious side effects of the treatment, such as cachexia*, and also increases the risk of infections, consequently reducing the chances of survival.

Following up on individual dietary patterns by, for example, an oncologist or general dietician can contribute to an improved appetite and food intake, retaining muscle mass and the decrease of side-effects resulting from the treatment, leading to an improved quality of life.

Nutritional problems that can result from cancer and its treatment are discussed in a separate [guide](#) to be found on our website.

Using dietary supplements such as vitamins, minerals and herbal remedies taken during cancer treatment remains a controversial topic. In the event of a deficiency of certain essential vitamins and minerals as a result of the treatment, the doctor can prescribe specific supplements. We examine this issue in the guide on food supplements on our website [link to: [Supplements Guide](#)]. If a patient uses or intends to take supplements, the treating doctor must be informed because some supplements can interfere with the treatment.



2. STRIVE FOR SUFFICIENT PHYSICAL ACTIVITY

The therapeutic importance of physical exercise, both during and after cancer treatment is being evermore demonstrated.

Various studies have examined the effect of physical activity on the prognosis of different types of cancer, including breast cancer, prostate cancer, ovarian cancer and colorectal cancer.

Studies conducted on breast cancer, colorectal cancer, prostate cancer and ovarian cancer survivors have shown that patients who were regularly physically active were less likely to relapse, both during and after the treatment, and were more likely to survive when compared to patients who were not physically active.

A recent meta-analysis* of 16 cohort studies*, comprising 23,360 breast cancer patients, showed that moderate to intensive physical activity after diagnosis lowered the mortality rate from breast cancer by 29% on average, and lowered the overall mortality rate by 43% when compared to those who had little exercise.

Scientists at the American College of Sports Medicine have shown that physical activity during and after cancer treatment is not only safe and possible during the treatment, but it will also benefit a patient's physical, emotional and functional capacities.

It can reduce treatment related side effects such as fatigue, loss of muscle mass, weight gain, loss of bone density (resulting in an increased risk of osteoporosis*), incontinence, pain, decreased cardiac function, anxiety and depression, which will improve quality of life and the prognosis.

A reduction in physical activity is often associated with other side effects, such as loss of appetite, which can lead to loss of muscle mass and one's resilience. This can send a person into a downward spiral and make them feel fatigued. The loss of muscle mass together with reduced aerobic fitness* makes it difficult for the patient to perform daily activities, reducing the quality of life and increasing the chances of mortality. That is why it is important to avoid complete inactivity and remain physically active as much as possible.

Getting regular exercise may reduce your body's levels of oestrogen* and other hormones that could promote cancer. Inflammation that may cause a kind of cellular damage, is also reduced by physical activity. Cellular damage increases the chance of the body developing cancer.

The amount of physical activity required for it to benefit the prognosis is still unclear, and it can vary according to the type of cancer, the stage of the disease, the type of treatment and the patient's lifestyle.

The American College of Sports Medicine has also drawn up exercise guidelines for cancer survivors. <http://www.ncbi.nlm.nih.gov/pubmed/20559064>



According to the recommendations of the American College of Sports Medicine, one must exercise moderately for at least 150 minutes a week or intensively (aerobic exercise) for at least 75 minutes a week, and also do resistance training twice a week for at least 10 minutes.

Aerobic exercise is the type of moderate to intensive physical activity that a person can perform for longer than a few minutes in order to improve cardiorespiratory (or aerobic) fitness*. Examples include jogging, cycling, dancing and swimming.

Resistance training revolves around exercises that contract the muscles, increasing muscle mass, muscle strength and bone mass. Examples include weightlifting, powerlifting, bodybuilding and discus throwing.

A recent meta-analysis*, comprising 71,654 cancer patients focusing on the importance of cardiorespiratory fitness* have shown that the risk of cancer mortality for patients with a high degree of cardiorespiratory fitness* is 45% lower on average when compared to patients with a low degree of cardiorespiratory fitness*. The same risk was also lower by an average of 20% among patients with an average level of cardiorespiratory fitness*.

With respect to cancer survivors who are physically active, their cardiovascular system is in better condition, they have greater muscular strength and they are less fatigued than those who are not active. Fatigue resulting from cancer or its treatment can even continue for years in some cases. That is why it is highly recommended that patients remain physically active on a regular basis and for long periods.

For cancer survivors who were physically inactive before the diagnosis, it is best to start off with low-intensity exercises, such as stretching and strolling. They should gradually increase their level of physical activity.

Elderly patients suffering from osteoporosis* and patients with bone metastases must exercise with caution and take care not to break any bones. It is best if they seek professional guidance when exercising.

Bed-ridden patients should also partake in physical activity in order to limit loss of fitness and muscle and bone mass.

It's better to do something than nothing – 'avoid inactivity', even when being subjected to extreme treatments.

Please also note that a number of studies demonstrate that sitting for long periods can be hazardous to your health. That is why it is best to not sit for longer than an hour at a time, taking breaks by standing upright or, if possible, walking around.

Before embarking on a physical exercise routine, cancer patients must be screened. It must be determined what is individually feasible, with follow-ups conducted by their treating doctor and physiotherapist* being essential.



Those undergoing chemotherapy* and/or radiotherapy* who are already following an exercise programme might have to cut back for a while, but it is important that they continue to exercise as much as possible.

Cancer patients receiving radiotherapy* should avoid swimming in swimming pools, as the chlorine could harm their skin.

Patients with reduced immunity should avoid public sports facilities and swimming pools until their white blood cells are replenished.

Patients suffering from severe anaemia should adjust their level of physical activity until they have recovered from the disorder.

Patients fitted with catheters or feeding tubes must also be cautious and avoid swimming pools, lakes, seawater or any other microbial exposure, given that they run an increased risk of infections. It is best not to involve those areas where the catheters are located in resistance or muscle exercises, as they could come loose.

For information purposes, please find below an overview of the guidelines for preventing cancer from the ACS and the WCRF.

- Adults: try to engage in moderate to vigorous physical exercise for at least 30 minutes a day, minimum five days a week, over and above your normal daily activities; 45 to 60 minutes of intensive physical exercise is even better.
- Children and teenagers: try to engage in moderate to intensive physical exercise for at least 60 minutes a day no less than five times a week.
- Examples of moderate intensity exercise include walking, dancing, gardening, horseback riding, yoga, golf and gardening.
- Examples of intensive physical exercise include jogging or running, cycling, aerobic dancing, football, swimming, hockey and heavy manual labour.

It is never too late to begin incorporating physical activity into your daily routine.



3. STICK TO A HEALTHY DIET CONSISTING PRIMARILY OF PLANT-BASED FOOD PRODUCTS

A variety of observational studies* suggest that nutrition and specific diets can influence the progression of cancer, the risk of relapse and overall mortality rates among cancer survivors. Most of these studies were conducted using breast cancer patients, but a number also involved patients with colon and prostate cancer.

Some of these studies showed that a healthy diet, consisting primarily of plant-based products, such as vegetables, fruit, wholegrain products and pulses such as lentils, beans and nuts, is certainly recommended for cancer survivors. This type of diet is believed to also protect the body against the relapse of certain types of cancer.

A meta-analysis* suggests that eating a low fat diet after being diagnosed with breast cancer can boost survival rates, as the risk of relapse is reduced by 23%.

Another study that involved 1,893 women with early-stage invasive breast cancer demonstrated that the frequent daily use of full fat dairy products – but not of skimmed dairy products – was associated with higher mortality rates after patients were diagnosed with breast cancer. The use of full fat dairy products raised oestrogen* levels, which could increase the risk of relapse and mortality.

According to a study that involved 4,577 men with non-metastasized prostate cancer, substituting carbohydrates* and meat products as much as possible with plant-based products, such as nuts and vegetable oils, could lead to decreased mortality. Those males that consumed more plant-based products after their diagnosis ran a lower risk of mortality. This can be explained by, among other things, the fact that plant-based products contain a heterogeneous mix of mono- and polyunsaturated fatty acids*.

An observational study* conducted among 1,009 survivors of colorectal cancer (stage III) showed that persons following a Western diet, consisting of the frequent consumption of red and processed meat, refined carbohydrates* and sweets, had a higher risk of relapse when compared to those on a healthy diet that consisted of large quantities of vegetables, fruit, poultry, fish, etc.

Some studies suggest that omega-3 fatty acids can offer certain benefits to cancer survivors, including the alleviation of cachexia* and an improvement in quality of life. Further research is required in order to confirm this. But it is a fact that certain cancer treatments increase the chance of cardiovascular afflictions, and therefore a diet that includes omega-3 fatty acids, derived from foods such as walnuts, fatty fish and eggs, is recommended. This will decrease the chance of cardiovascular diseases, and thus also reduce the overall risk of mortality.

Given that trans fats increase the risk of cardiovascular disease, their consumption is discouraged for cancer survivors. Major sources of trans fats are some margarines, pastries and snacks.



A protein-rich diet is recommended during treatment. It is best not to consume red and processed meat but rather to have a diet consisting of fish, lean meat, poultry, skimmed dairy products, nuts, seeds, pulses and soya products. Soya contains a variety of phytochemicals*, including phytoestrogens and antioxidants. According to the WCRF's "Continuous Update Project Report" on "Diet, nutrition, physical activity and breast cancer survivors", published in 2014, the consumption of soya and soya products after being diagnosed reduces the risk of death. Please note that this concerns consuming soya in one's food and not in the form of supplements. The latter are not recommended for breast cancer survivors.

In anticipation of further research, the AICR and the WCRF advise that the general recommendations for preventing cancer be followed. A recent study involving 2,017 elderly female cancer survivors demonstrated that following these recommendations was associated with a lower overall mortality and a better quality of life. Following the guidelines concerning physical activity had the greatest impact on the overall mortality rates and mortality as a result of cancer.

The recommendations are:

- Try to eat at least five portions (at least 400 grams) of fruit and vegetables every day. Keep a varied selection and eat them as a snack. Try to include a portion of fruit or vegetables with every meal. They are crammed with beneficial vitamins, minerals, fibres and other bioactive ingredients*, which could aid in the prevention of cancer.
- Choose wholegrain products instead of refined (processed) grains and sugars. Eat wholegrain bread, rice, pasta and grains, as these are rich in dietary fibre. They are believed to combat the risk of developing cardiovascular disease. They may play a role in preventing gastric and colon cancers and also in hormone-dependent cancers like breast and prostate cancer. Refined products have lost a large proportion of their dietary fibre, vitamins and minerals because they are ground and the bran and seeds removed.
- Limit your intake of refined carbohydrates* and sweetened drinks (soft drinks) as well as processed food, including pastries, fast foods, sweetened cereals and other sweets. These contain a great deal of added sugars, fats and/or salt, provide no added value to your diet and can interfere with the insulin* action which can lead to insulin resistance*.
- Try to achieve the best possible energy balance, which means that the energy introduced (through your diet) must be balanced with the energy expended. Pay attention to the total calorie intake in order to achieve and retain a healthy body weight. It is important that you are aware that some calorie-rich products are good for you and consequently can be a part of a healthy dietary regime, including nuts, dried fruit, fatty fish, vegetable oils and others.



- Limit red meat (beef, pork and lamb) and processed meat (salami, ham, sausage, etc.) consumption to less than 500 grams a week. Various epidemiological studies* have linked the high consumption of red and processed meat to an increased risk of colon cancer. A study by the WCRF/AICR has shown that eating 100 grams of red meat every day (700 grams a week) increases the risk of colon cancer by 17% compared to someone who eats no red meat. Eating 100 grams of processed meat a day (700 grams a week) meanwhile increases the risk of colorectal cancer by 36% when compared to someone who eats no processed meat.
- Fish, poultry and pulses are a good alternative to beef, pork, mutton and lamb. When eating meat, select lean cuts and eat small portions.
- When preparing meat and fish, the best option is to steam, poach or bake it at a relatively low temperature. Cooking meat at a high temperature over an extended period or barbecuing it, could release certain harmful substances, such as heterocyclic amines and polycyclic aromatic hydrocarbons, which could increase the risk of some types of cancer.
- Cut your salt intake, as excessive salt consumption increases the chance of high blood pressure and gastric cancer. Salt is used as a preservative and can be found in many processed products, like bread, snacks, breakfast cereals and ready-made products such as soups and sauces.
- Males should drink no more than two glasses of alcohol a day and females one glass. One glass is the equivalent of 250 ml of beer, 100 ml of wine or 25 ml of liquor.

Observational research has shown that the use of alcohol has both positive and negative effects on a person's health. Drinking one (for women) or two (for men) glasses of alcohol a day can lower the risk of cardiovascular disease. But larger quantities do not offer additional benefits, and can increase the risk of certain types of primary cancers, including mouth cancer, throat cancer, laryngeal cancer, oesophageal cancer, liver cancer, breast cancer and possibly also colon cancer. That is why it is important that alcohol consumption be examined on an individual basis according to the type of cancer, the stage of the disease, the treatments, the risk of side effects such as mucous membrane infection, and the risk of relapse or of certain new primary cancers appearing. Many health professionals frequently discourage the consumption of alcohol during chemotherapy* and/or radiotherapy*. The WCRF strongly recommends that no alcohol at all be consumed by cancer survivors suffering from mucositis or those with head and neck cancer undergoing radiotherapy* or chemotherapy*.

Try to drink as much water or other healthy liquids as possible – at least eight glasses a day, unless you have to limit your liquid intake for medical reasons. Also try to avoid very hot drinks.



Should one eat organically grown/manufactured food? According to a recent meta-analysis* the concentration of various antioxidants, such as certain polyphenols, was strikingly higher in organically grown foods when compared to their non-organic counterparts. Moreover, the meta-analysis* showed that the level of cadmium, a toxic metal, was lower and that pesticide residue levels were four times lower in organic crops when compared to non-organic crops. However, no epidemiological studies* have to date been conducted on people that show that organically grown foods reduce the risk of developing cancer, nor the risk of a relapse and the progression of cancer, when compared to other production methods.

It remains unclear whether a vegetarian diet can reduce the chances of developing cancer, but vegetarian foods do contain many healthy properties as they are high in fibre and rich in vitamins, minerals and phytonutrients*. Vegans, especially children and premenopausal women should supplement their diets with vitamin B12, zinc, iron and calcium. It is important for vegetarians and vegans to ensure they get enough protein by consuming a wide variety of vegetables, fruit, legumes, nuts, seeds, soy products and wholegrain products.

The media and the Internet in particular, are used to distribute information on specific diets that claim they can cure cancer. We can conclude that there is still no scientific evidence that can prove that these diets are effective against cancer. If one intends to follow a special diet, then it must first be discussed with the treating doctor or dietician.



4. REFERENCES

Ali AM, Schmidt MK, Bolla MK et al. Alcohol consumption and survival after a breast cancer diagnosis: a literature-based meta-analysis and collaborative analysis of data for 29,239 cases. *Cancer Epidemiol Biomarkers Prev.* 2014 Jun; 23(6):934-45

Amling CL. The association between obesity and the progression of prostate and renal cell carcinoma. *Urol Oncol* 2004; 22:478-484.

Bagnardi V, Rota M, Botteri E et al. Light alcohol drinking and cancer: a meta-analysis. *Annals of Oncology* 00: 1-8, 2012

Ballard-Barbash R, Friedenreich CM, Courneya KS et al. Physical activity, biomarkers, and disease outcomes in cancer survivors: a systematic review. *J Natl Cancer Inst* 2012; 104:815-840

Caan BJ, Natarajan L, Parker B et al. Soy food consumption and breast cancer prognosis. *Cancer Epidemiol Biomarkers Prev.* 2011; 20:854-858.

Calle EE, Rodriguez C, Walker-Thurmond K, Thun MJ. Overweight, obesity, and mortality from cancer in a prospectively studied cohort of U.S. adults. *N Engl J Med* 2003; 348:1625-1638.

Carayol m, Bernard P, Boiché J et al. Psychological effect of exercise in women with breast cancer receiving adjuvant therapy : what is the optimal dose needed ? *Ann Oncol.* 2013 Feb 24(2):291-300

Chan DS, Lau R, Aune D, et al. Red and processed meat and colorectal cancer incidence: meta-analysis of prospective studies. *PLoS One* 2011;6: e20456.

Chlebowski RT, Aiello E, McTiernan A. Weight loss in breast cancer patient management. *J Clin Oncol* 2002; 20:1128-1143.

Chlebowski RT, Blackburn GL, Thomson CA et al. Dietary fat reduction and breast cancer outcome: interim efficacy results from the Women's Intervention Study. *J Natl Cancer Inst.* 2006; 98:1767-1776.

Cho J, Jung S-Y, Lee EJ et al. A review of breast cancer survivorship issues from survivors perspectives. *Journal of Breast Cancer* 2014; 17(3): 189-199.

Courneya KS, Booth CM, Gill S et al. The Colon Health and Life-Long Exercise Change trial: a randomised trial of the National Cancer Institute of Canada Clinical Trials Group. *Current Oncol* 2008; Vol 15, 6,: 279-285.

Courneya KS, Friedenreich CM. *Physical activity and cancer.* Vol.186. Springer-Verlag, Heidelberg, 2011. 387p.

Courneya KS. Exercise in cancer survivors: an overview of research. *Med Sci Sports Exerc* 2003; 35:1846-1852

Davis NJ, Batehup L and Thomas R. The role of diet and physical activity in breast, colorectal and prostate cancer survivorship: a review of the literature. *British Journal of Cancer,* 2011; 105: S52-S73.

Demark-Wahnefried W. Cancer survival: Time to get moving? Data accumulate suggesting a link between physical activity and cancer survival. *J Clin Oncol* 2006; 24:3517-3518.

Dobek J, Winters-Stone K, Bennett J et al. Musculoskeletal changes after 1 year of exercise in older breast cancer survivors. *J Cancer Surviv,* 2014, 8:304-311

Doyle C, Kushi LH, Byers T et al. Nutrition and physical activity during and after cancer treatment: an American Cancer Society guide for informed choices. *CA Cancer J Clin,* 2006; 56:323-353.

Esposito K, Kastorini CM, Panagiotakos D et al. Mediterranean diet and metabolic syndrome: an updated systematic review. *Rev Endocr Metab Disord* 2013;14:255-263

Fong DYT, Ho JWT, Hui BPH, et al. Physical activity for cancer survivors: meta-analysis of randomised controlled trials. *Br. Med J* 2012; 344: e70

Food, nutrition, physical activity and the prevention of cancer: a global perspective, WCRF/AICR 2007

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Friendenreich, CM, Woolcott, CG, Mc Tiernan A et al. Alberta physical activity and breast cancer prevention trial: sex hormone changes in a year-long exercise intervention among postmenopausal women. *J Clin. Oncol.* 2010; 28: 1458-1466.

Gioulbasanis I, Martin L, Baracos VE, et al. Nutritional assessment in overweight and obese patients with metastatic cancer: does it make sense? *Ann Oncol* 2014, Oct 30

Goodwin PJ, Ennis M, Pritchard KI et al. Diet and breast cancer: evidence that extremes in diet are associated with poor survival. *J Clin Oncol* 2003; 21:2500-2507.

Holmes MD, Chen WY, Feskanich D, Kroenke CH, Colditz GA. Physical activity and survival after breast cancer diagnosis. *JAMA* 2005;293:2479-2486.

Holtzman J, Schmitz K, Babes G, et al. Effectiveness of behavioral interventions to modify physical activity behaviors in general populations and cancer patients and survivors. Evidence Report/Technology assessment No. 102 (prepared by the Minnesota Evidence-based Practice Center, under contract No. 298-02-0009.) AHRQ Publication No. 04-E027-2. Rockville, MD. Agency for Healthcare Research and Quality. June 2004.

Ibrahim EM, Al-Homaidh A. Physical activity and survival after breast cancer diagnosis: meta-analysis of published studies. *Med Oncol.* 2011;28:753-765.

Inoué-Choi M, Robien K, Lazovich DA. Adherence to the WCRF/AICR guidelines for cancer prevention is associated with lower mortality among older female cancer survivors. *Cancer Epidemiol Biomarkers Prev.* 2013 May; 22(5): 792-802.

Kampman E, Vrieling A, van Duijnhoven FJ et al. Impact of diet, Body Mass Index, and Physical Activity on Cancer Survival. *Curr Nutr Rep* 2012; 1:30-36.

Knols R, Aaronson NK, Uebelhart D, et al. Physical exercise in cancer patients during and after medical treatment: a systematic review of randomized and controlled clinical trials. *J Clin Oncol* 2005; 23:3830-3842.

Kroenke CH, Kwan ML, Sweeney C et al. High-and low-fat dairy intake, recurrence, and mortality after breast cancer diagnosis. *JNCIJ Natl Cancer Inst* (2013) 105, 9, 593-594

Kwan ML, Kushi LH, Weltzien E et al. Alcohol consumption and breast cancer recurrence and survival among women with early-stage breast cancer: the life after cancer epidemiology study, *J Clin Oncol.* 2010 Oct 10;28(29):4410-6

Kushi LH, Byers T, Doyle C et al and the American Cancer Society 2006 nutrition and physical activity guidelines advisory committee. American cancer society guidelines on nutrition and physical activity for cancer prevention: reducing the risk of cancer with healthy food choices and physical activity. *CA Cancer J Clin* 2006;56:254-281.

Langstein HN, Norton JA. Mechanisms of cancer cachexia. *Hematol Oncol Clin N Am* 1991;5:103-123.

Ligibel JA, Alfano CM, Courneye KS et al. American Society of Clinical Oncology Position Statement on Obesity and Cancer. *JCO* 2014, vol 32; 31:3568- 3574

Ligibel JA, Lifestyle factors in cancer survivorship. *J Clin Oncol* 2012; 30: 3697-3704

Maasland D, Van den Brandt P, Kremer B et al. Alcohol consumption, cigarette smoking and the risk of subtypes of head-neck cancer: results from the Netherlands Cohort Study. *BMC Cancer* 2014, 14/187

McMahon K, Brown JK. Nutritional screening and assessment. *Semin Oncol Nurs* 2000;16:106-112.

Meyerhardt JA, Niedzwiecki D, Hollis D et al. Association of dietary patterns with cancer recurrence and survival in patients with stage III colon cancer. *JAMA* 2007; 298(7): 754-764

Meyerhardt JA, Heseltine D, Niedzwiecki D, Hollis D, Saltz LB, Mayer RJ, Thomas J, Nelson H, Whittom R, Hantel A, Schilsky RI, Fuchs CS. Impact of physical activity on cancer recurrence and survival in patients with stage III colon cancer: Findings from CALGB 89803. *J Clin Oncol* 2006; 24:3535-3541.

Mustian KM, Sprod LK, Palesh OG, et al. Exercise for the management of side effects and quality of life among cancer survivors. *Curr sports med rep.* 2009;8(6): 325-330.



- Newcomb P, Kampman E, Trnetham-Dietz A et al. Alcohol consumption before and after breast cancer diagnosis: associations with survival from breast cancer, cardiovascular disease, and others. *Journal of Clinical Oncology*, 2013; 31:1939-1946
- Nitenberg G, Raynard B. Nutrition impact symptoms in the oncology patient. *Oncology Issues* 2002;17:15-17.
- Richman EL, Kenfield SA, Chavarro JE et al. Fat intake after diagnosis and risk of lethal prostate cancer and all-cause mortality. *JAMA Intern Med*. 2013 Jul 22;173(14):1318-26
- Robien K, Demark-Wahnefried W, Rock CL . Evidence-based nutrition guidelines for cancer survivors: current guidelines, knowledge gaps, and future research directions. *J Am Diet Assoc* 2011;111:368-375.
- Rock CL, Demark-Wahnefried W. Nutrition and survival after the diagnosis of breast cancer: a review of the evidence. *J Clin Oncol* 2002; 20:3302-3316.
- Rock CL, Pande C, Flatt SW, et al. Favorable changes in serum estrogens and other biologic factors after weight loss in breast cancer survivors who are overweight or obese. *Clin Breast Cancer* 2013 Jun; 13 (3): 188-95.
- Rock CL, Doyle C, Demark-Wahnefried W et al. Nutrition and physical activity guidelines for cancer survivors. *CA Cancer J Clin* 2012; 62:242-274.
- Schattner M, Shike M. Nutrition Support of the Patient with Cancer, in Shils ME, Shike M, Ross AC (eds). *Modern Nutrition in Health and Disease*. 10th ed. Philadelphia, PA: Lippincott Williams & Wilkins; 2006:1290-1313.
- Schmid D, Leitzmann MF. Cardiorespiratory fitness as a predictor of cancer mortality: a systematic review and meta-analysis. *Annals of Oncology*, Jul; 9, 2014.
- Schmid D, Leitzmann MF. Association between physical activity and mortality among breast cancer and colorectal cancer survivors. *Ann Oncol* 2014 Jul; 25(7): 1293-311.
- Schmitz KH, Holtzman J, Courneya KS, et al. Controlled physical activity trials in cancer survivors : a systematic review and meta-analysis. *Cancer Epidemiol Biomarkers Prev* 2005;14 :1588-1595.
- Schmitz KH, Courneya KS, Matthews C, et al. American college of sports medicine roundtable on exercise guidelines for cancer survivors. *Med Sci Sports Exerc*. 2010;42(7):1409-1426.
- Siegel EM, Ulrich CM, et al. The effects of obesity and obesity-related conditions on colorectal cancer prognosis. *Cancer Control* 2010; 17:52-57.
- Slavin JL. Mechanisms for the impact of whole grain foods on cancer risk. *J Am Coll Nutr* 2000;19: 300S-307S.
- Smith-Warner SA, Speigelman D., Yaunn SS, et al. Alcohol and breast cancer in women: a pooled analysis of cohort studies. *JAMA* 1998;279:535-540.
- Stichting Wereld Kanker Onderzoek Fonds; aanbevelingen ter preventie van kanker; Amsterdam, Nederland,2008.
- Strasser B, Steindorf K, Wiskemann J et al. Impact of resistance training in cancer survivors: a meta-analysis, *Med Sci Sport Exerc* 2013, 45 (11) 2080-95
- Ströhle A, Zänker K, Hahn A. Nutrition in oncology: the case of micronutrients. *Oncology reports* 2010; 24:815-828.
- Tiernan AM, Irwin M and VonGruenigen V. Weight, physical activity, diet, and prognosis in breast and gynaecologic cancers. *J Clin Onc*. 2010; 28: 4074-4080.
- Verberne L, Bach-Faig A, Buckland G et al. Association between the Mediterranean diet and cancer risk: a review of observational studies. *Nutrition and Cancer*, 62(7), 860-870.
- Wolin KY, Schwartz AL, Matthews CE et al. Implementing the exercise guidelines for cancer survivors. *J Support Oncol* 2012; 10(5):171-177



World Cancer Research Fund International Continuous Update Project Report, Systematic Review on diet, nutrition, physical activity and survival and second cancers in breast cancer survivors 2014.

Xing MY, Xu SZ, Shen P. Effect of low-fat diet on breast cancer survival: a meta-analysis. Asian Pac J Cancer Prev 2014; 15 (3): 1141-4.

Zhong S, Jiang T, Ma T et al. Association between physical activity and mortality in breast cancer: a meta-analysis of cohort studies. Eur J of Epidemiol 2014; 29: 391- 404



5. GLOSSARY

Aerobic fitness

The endurance of the cardiorespiratory system, (the heart and the lungs). It determines the ability of an individual to perform physical activities over extended periods.

Androgen

A type of hormone that promotes the development and maintenance of male sex characteristics.

Bioactive ingredient

In a literal sense, bioactive substances are chemicals with a specific biological or physiological activity or function. They are found in foods (occurring both naturally and artificially added) and many appear to be beneficial to our health. Some bioactive compounds can, for example, have the same effect as antioxidants and protect the body from free radicals.

Cachexia

Cachexia is a syndrome where the patient loses weight and muscle mass and is weakened and fatigued.

Cardiorespiratory fitness

Cardiorespiratory (concerning the heart and breathing) fitness or aerobic work capacity is the ability of the respiratory and circulatory system to supply oxygen to the body's muscles when performing physical activities over an extended period. VO₂max, or the maximum oxygen uptake, expressed in ml/kg/minute, is a measure of cardiorespiratory fitness.

Carotenoid

A substance found in yellow and orange fruits and vegetables and in dark green leafy vegetables. Carotenoids can reduce the risk of cancer.

Carbohydrates

Carbohydrates are the body's building blocks and a major source of fuel. Carbohydrates are a collective name for starch and a variety of sugars. These carbohydrates are digested in the gastrointestinal tract and are released into our blood stream in the form of glucose. Glucose gives our bodies energy and it is indispensable to our wellbeing. Excess glucose is stored in our bodies as fat.

Chemotherapy

A type of cancer treatment that kills cancer cells and/or limits their growth. These drugs are usually administered to the patient by slow infusion into a vein but can also be administered orally, by direct infusion to the limb or by infusion to the liver, according to the cancer location.

Clinical trial

A type of research study that tests the degree to which new medical approaches work in people. These studies test new methods of screening, prevention, diagnosis or treatment of a disease. Also called clinical study.

**Cohort**

A group of people who will be followed-up for a certain period of time in a trial.

Epidemiological studies

Studies performed involving human populations where the researchers examine the links between the presence of a health effect, such as cancer, and a speculative factor that caused that cancer, such as a chemical substance.

Fatty acid

A major component of fats that is used by the body for energy and tissue development.

Insulin

A hormone made in the pancreas. Insulin controls the amount of sugar in the blood by moving it into the cells, where it can be used by the body for energy.

Insulin-like growth factor 1 (IGF-1)

IGF-1 is a protein hormone with a molecular structure that resembles insulin* and is primarily produced in the liver. It plays a role in cell division and the lifecycle of a cell. IGF-1 production is regulated by growth hormones (GH), which are manufactured by the pituitary gland. The quantity of IGF-1 in the blood is greatly dependant on age, and peaks during puberty.

Insulin resistance

When the body does not respond properly to insulin*, it has become insensitive to it, this is called insulin resistance. Insulin* is the hormone that lowers blood sugar levels. It thus balances the sugar in the blood. Once the body does not respond properly to insulin* anymore, too much sugar in the blood remains unused which may cause health problems such as diabetes.

Meta-analysis

A meta-analysis statistically combines the results of a number of comparable clinical trials, which are bundled together and recalculated. This makes it possible to judge the effect of an intervention or treatment with a greater degree of reliability.

Metabolic syndrome

It is a metabolic disorder, also called insulin resistance* syndrome, or syndrome X, which can be caused by an imbalance between food intake and physical activity. This causes a disturbance in the regulation of the metabolism by the brain. It is usually accompanied by high blood pressure, diabetes, obesity and a too high level of cholesterol. This disorder can lead to long-term cardiovascular disease, type 2 diabetes, and possibly some cancers

Observational study

A study where the investigator observes the natural course of events in a population. This is in contrast with an experimental study where the course of events is deliberately altered, usually by assigning subjects to a treatment group or to a control group.

**Oestrogen**

A group of hormones created in the body, which play an important role in the development of the female sex characteristics such as the breasts, the womb and the vagina. They also regulate the menstrual cycles and pregnancy. Therefore they are also called female hormones.

Osteopenia

An age-related condition in which the bone density decreases. The loss of bone mass is not as dramatic as when the person suffers from osteoporosis* and is not associated with bone fractures.

Osteoporosis

A condition that is marked by a decrease in bone mass and density, causing bones to become fragile.

Physiotherapist

A therapist who treats pain in the locomotor apparatus, physical restraints and walking and balance issues using exercise therapy (movement therapy), massage therapy and therapies that employ physiological instruments, such as infrared and UV therapy.

Phytochemicals

Phyto means 'derived from plants'. A phytochemical is a chemical compound that is found naturally in plants. The term is used for substances that may affect health, but are not yet established as essential nutrients. Plant foodstuffs can contain up to 100,000 different phytochemicals, many of which have an antioxidant effect.

Radiotherapy

A therapy in which radiation is used in the treatment of cancer always oriented to the specific area of the cancer.

Sarcopenic obesity

Sarcopenia is the loss of muscle mass and the associated reduction of muscle strength. Sarcopenic obesity is a form of sarcopenia that is characterized by a high fat mass and being (chronically) overweight, coupled with the loss of muscle mass. Sarcopenic obesity and sarcopenia can occur in a number of types of cancer.

Saturated fatty acids

Fats that have their chemical structure wholly or partially saturated with hydrogen atoms. Saturated fatty acids are primarily found in animal products, such as butter, cheese, milk, fatty beef and chocolate. Some vegetable fats also contain a high level of saturated fatty acids, including cocoa butter, palm oil and coconut fat. Saturated fatty acids are generally coagulated (solid) at room temperature. They increase cholesterol levels in the blood, which can lead to fat being deposited on the walls of the blood vessels, blocking them up. Because the flow of blood through the blood vessels is inhibited, you have a greater chance of suffering from cardiovascular diseases.