



World
Cancer
Research
Fund International

**The impact of diet, weight and physical activity
and the risk of dying from breast cancer**

A major review of existing research

2022



Unifying research on nutrition, physical activity and cancer

Contents

Introduction	3
Executive summary	4
Key findings	5
Breast cancer report Q&A	6
• Diet	8
• Physical activity	9
• Body weight	11
Published papers	13
Author contributors	14
Global Cancer Update Programme	15

Introduction

In 2020, breast cancer was the most common cancer and the leading cause of cancer death in women globally, with 2.3 million cases and an estimated 700,000 deaths. As of the end of 2020, there were 7.8 million women worldwide who had survived at least five years after a breast cancer diagnosis.

World Cancer Research Fund International (WCRF International) commissioned a major review of the published research that seeks to understand the links between diet, physical activity, weight and risk of death after a breast cancer diagnosis.

The review is part of WCRF International's Global Cancer Update Programme, and the result of an ongoing analysis of decades of evidence by world-renowned, independent experts from across the globe.

The review was carried out on behalf of WCRF International by a team of researchers from Imperial College London and has been funded by the WCRF Network of international charities. It uses established methodology to ensure that it was carried out to the highest standard.

About Global Cancer Update Programme

WCRF International's Global Cancer Update Programme provides an analysis of international scientific research into how diet, nutrition, physical activity and weight affect cancer risk and survival. The programme is produced in partnership with American Institute for Cancer Research, World Cancer Research Fund in the UK and Wereld Kanker Onderzoek Fonds in the Netherlands.

As part of its development, the Global Cancer Update Programme has built the largest cancer prevention database in the world, housed at Imperial College in London. It is the only authoritative scientific resource of its kind, is evaluated by an independent panel of leading cancer experts, and to date contains approximately 12,000 papers on cancer prevention and survival.

About World Cancer Research Fund International

World Cancer Research Fund International examines how diet, weight and physical activity affect the risk of developing and surviving cancer.

As part of an international network of charities, we have been funding life-saving research, influencing global public health policy and educating the public since 1982.

While society continues to search for a cure, our prevention and survival work is helping people to live longer, happier and healthier lives – free from the devastating effects of cancer.

Executive summary

Diet, nutrition, physical activity, weight and the risk of death following a breast cancer diagnosis

World Cancer Research Fund International (WCRF International) has commissioned a major review of the published research that seeks to understand the links between diet, physical activity, weight and risk of death after a breast cancer diagnosis.

The review has been carried out by a team of researchers from Imperial College London on behalf of WCRF International, and the results judged by a Panel of independent global experts. The review has been funded by the WCRF Network of international charities.

The review found strong evidence that a higher body weight after a breast cancer diagnosis increases a person's risk of death. It also found some evidence that doing more physical activity lowers the risk of death.

The review looked at the impact of diet, physical activity and weight from the point of breast cancer diagnosis. The timing that the diet, physical activity and body weight measurements were taken varied from immediately-post diagnosis to several years later.

The findings strengthen the case for women with breast cancer to make positive behaviour changes, supported by their healthcare team. These could include eating a healthy diet and being physically active, all of which play a role in maintaining a healthy weight.

The review is part of WCRF International's Global Cancer Update Programme, and the result of an ongoing analysis of decades of evidence by world-renowned, independent researchers from across the globe.

The review used an established methodology to ensure that it was carried out to the highest standard. Once completed, the resulting evidence was interpreted and judged by an independent Panel of experts convened by WCRF International.

Women diagnosed with breast cancer are living longer than ever before, and the number of women who live with the disease for at least five years is growing each year. This means that the findings of this research and the judgements from the Panel, along with the recommendations that WCRF International will look to develop for those living with and beyond cancer in the future, are more important than ever.

Being an unhealthy weight increases the risk of developing other chronic diseases such as cardiovascular disease and diabetes which in turn also increase the risk of death after a breast cancer diagnosis.

This research helps us to better understand how certain health-related factors and behaviours can affect a woman's long-term health after a breast cancer diagnosis – and how we, as an organisation and network of charities, can support people to live healthily beyond a diagnosis of cancer.

People living with and beyond breast cancer should always consult with their healthcare team before making any changes to their diet or physical activity routine.

Breast cancer among men is rare and all the studies in this review included women only.

Key findings of research after a breast cancer diagnosis

World Cancer Research Fund International (WCRF International) has undertaken a major review of existing research that seeks to understand the links between diet, physical activity, weight and risk of death after a diagnosis of breast cancer. The work has been carried out by a team of researchers from Imperial College London on behalf of WCRF International, and has been funded by the WCRF Network of international charities. The review's key findings are set out below.

Diet

108 studies were analysed from around the world, comprising more than 151,000 women with breast cancer; among them, 14,900 died, 5,900 of breast cancer.

There was some evidence that eating soy could reduce the risk of death, as well as the recurrence of breast cancer.

There was some evidence that eating more dietary fibre could reduce the risk of death.

There was also some evidence that people with certain healthy eating patterns have a reduced risk of death.

Physical activity

23 studies were analysed from around the world, comprising more than 39,000 women with breast cancer; among them, around 5,000 died, 2,000 of breast cancer.

Most studies looked at recreational physical activity, such as aerobics, walking and running, with limited studies on other types of activity.

There was some evidence that being more physically active could reduce the risk of death after a breast cancer diagnosis.

There was also some evidence that physical activity could reduce the risk of breast cancer recurrence.

Body weight

226 studies were analysed from around the world, comprising more than 456,000 women with breast cancer; among them, 36,000 died, around 21,000 of breast cancer.

There was strong evidence that a higher body weight after diagnosis increases the risk of death.

There was some evidence that a higher body weight after diagnosis was linked to higher breast cancer recurrence.

Q&A about this Global Cancer Update Programme report

What is this review about?

World Cancer Research Fund International (WCRF International) has commissioned a major review of published research that seeks to understand the links between diet, physical activity, weight and risk of death after a breast cancer diagnosis.

The work has been carried out by a team of researchers from Imperial College London on behalf of WCRF International and a Panel of independent global experts was then convened to interpret and judge the evidence. The review has been funded by the WCRF Network of international charities.

Why did WCRF International conduct this review?

With the improvement in breast cancer survival rates, there is an increasing need to understand the relationship between key risk factors after a breast cancer diagnosis and the subsequent outcomes. This will help to better develop evidence-based recommendations for those living with breast cancer and beyond. To date, although there is a breadth of knowledge on the relationship between modifiable risk factors and breast cancer incidence, little is known about how they might influence outcomes after breast cancer diagnosis.

What were the top findings of the review?

The review found:

Diet

- Some evidence that eating food that contains soy reduced the risk of death and the recurrence of breast cancer.
- Some evidence that eating more dietary fibre reduces the risk of death.
- Some evidence that people with healthy eating patterns (for example limiting red, processed meat and fast-food consumption, eating more fruit and vegetables, and limiting alcohol) have a reduced risk of death.

Physical activity

- Some evidence that doing more physical activity lowers the risk of death.
- Some evidence that physical activity could reduce the risk of breast cancer recurrence.

Body weight

- Strong evidence that having a higher body weight after a breast cancer diagnosis increases a person's risk of death.

Why are these findings significant?

With recent improvements in cancer screening, diagnosis and treatment, women diagnosed with breast cancer are living longer than ever before. The results of these studies help us to better understand how modifiable risk factors can affect a person's long-term health after a breast cancer diagnosis.

The findings also strengthen the case for women with breast cancer, supported by their healthcare team, to make positive behaviour changes. This could include eating a healthier diet and being more physically active, both of which play a role in maintaining a healthy weight. Being a healthy weight also reduces the risk of other chronic diseases such as cardiovascular disease and diabetes.

People living with and beyond breast cancer should always consult with their healthcare team before making any changes to their diet or physical activity routine.

What is new about the findings from WCRF International's previous reports?

What is new is that this updated review found that many more studies have been carried out in recent years and this has resulted in more detailed recommendations where diet, nutrition, physical activity and body weight are concerned. We can now say that **there is strong evidence that having a healthy body weight, and some evidence that being physically active and following a diet rich in fibre and soy after breast cancer diagnosis are associated with better overall survival.**

Previous research – analysed as part of WCRF International's Third Expert Report – found some evidence that having a healthy body weight, being physically active and following a diet rich in fibre and soy after breast cancer diagnosis were associated with better overall survival. However, this evidence was limited and not enough to give specific recommendations for patients.

How far back in time does the review of research papers go?

These reviews updated the previous reviews carried out for our Third Expert Report in 2018, and the search included those and all studies up to 31 October 2021.

What is a systematic review?

A systematic review examines all the published research on a particular subject – setting out a clear scientific question. It makes available the protocol used to examine the published literature with inclusion and exclusion criteria.

What do you mean by some evidence?

“Some evidence” refers to a ‘limited suggestive’ conclusion. This means that there is evidence of an effect but there are issues with the evidence which could include the amount of research available or the quality of the research. The Panel of experts uses a [grading criteria](#) to ensure the evidence is judged appropriately.

Diet

How many studies were included in the diet review?

We analysed 108 studies which comprised more than 151,000 women with breast cancer, 14,900 died, 5,900 of breast cancer.

What were the main findings?

Soy

There was some evidence that eating food that contains soy reduces the risk of death and the recurrence of breast cancer.

What type of soy food did the studies include?

The studies looked at links between soy food and the risk of death by measuring the amount of soy in the diet and then estimated the amount of isoflavones and/ or soy protein. The studies do not distinguish between different soy food, the focus is the overall amount in the diet.

Dietary fibre

There was some evidence that higher consumption of dietary fibre reduces the risk of death.

Eating patterns

There was some evidence that people with healthy eating patterns have a reduced risk of death. In these studies, the eating patterns were specific patterns such as a low fat and high fibre/fruit/vegetable diet and following the WCRF/AICR Cancer Prevention Recommendations.

Where other dietary factors reviewed which could affect mortality risk after a diagnosis of breast cancer?

There were few studies available on the other dietary risk factors, which included alcohol, fruit and vegetables, red and processed meat, fish, eggs, milk and dairy products, nutrients such as fats, carbohydrate, animal protein, plant protein, supplements and vitamin D. The findings were therefore limited, and no conclusions could be made. More research in these areas is needed.

What are the percentage risk changes?

Soy: There was a 4% lower all-cause mortality risk for those consuming higher levels of isoflavone from soy foods, the equivalent of 2mg a day.

Fibre: Results showed a 13% lower risk of all-cause mortality for each 10g/day increase in fibre intake.

Physical activity

How many studies were included in the physical activity review?

We analysed 23 studies from around the world, comprising more than 39,000 women with breast cancer; among them, around 5,000 died, 2,000 of breast cancer.

What were the findings of the review on physical activity?

There was some evidence that being more physically active could reduce the risk of death after a breast cancer diagnosis.

There was also some evidence that physical activity could reduce the risk of breast cancer recurrence.

What are the percentage risk changes?

Women with the highest levels of physical activity were compared to those with the lowest levels. The most active women had an estimated 44% reduced risk of all-cause mortality and 42% of breast cancer mortality.

The estimated reduction in risk for every 10-unit metabolic equivalent of task (MET) -h/week increase in physical activity was 15% for all-cause mortality and 14% for breast cancer mortality. This was seen up to approximately 20 MET-h/week; at this level of physical activity there was 47% reduced risk of all-cause mortality and 38% of breast cancer mortality. There was little further reduction in risk with higher levels of physical activity.

What is MET?

The studies included in the review measured physical activity using a measure known as 'metabolic equivalent of task' (MET). 10 MET hours per week reflects approximately 75mins (1¼ hours) of vigorous activity per week or 150 minutes (2½ hours) of moderate activity per week.

Metabolic equivalent of task, or MET, is the rate at which the body uses energy (oxygen) during physical activity compared to the energy used when at rest. One MET is equivalent to 3.5ml oxygen (O₂) per kg of body weight per minute.

Light intensity activities, such as walking at a leisurely pace, may use 1.6 to 3 METs. Moderate intensity activities, such as a brisk walk, house cleaning or cycling at a light effort, may use 3 to 6 METs. Vigorous intensity activity, such as running or an aerobics session, may use more than 6 METs.

How much physical activity should someone living with breast cancer do?

Questions remain regarding exactly what type and amount of activity, such as frequency, duration and intensity are needed. In the absence of these, women living with and beyond breast cancer should aim to follow the general population's national guidelines for physical activity, under the guidance of their healthcare team.

What types of physical activity count?

According to the [WHO](#) adults should do at least 150–300 minutes of moderate-intensity aerobic physical activity; or at least 75–150 minutes of vigorous-intensity aerobic physical activity; or an equivalent combination of moderate- and vigorous-intensity activity throughout the week, for substantial health benefits.

The good news is that physical activity can take many forms including (but not limited to) gardening, walking, going to the gym and playing sports.

It is also important that we limit the amount of time we are sedentary – being seated or inactive.

Those diagnosed with cancer should speak to their healthcare professional before embarking on a new physical activity routine.

Does walking count?

Walking is a great way to increase physical activity as it does not need any special equipment and can be added into everyday life.

Body weight

What do you mean by body weight – in the paper it says body fatness?

We use the term body weight here for simplicity, but in fact the review included a number of measures related to body weight. Body weight itself can be difficult to interpret – what it means depends on several factors that determine how much of your weight is made up of fat and how much of muscle; where fat is stored in the body is also important.

The review included body mass index (BMI), waist circumference, waist-hip-ratio, and BMI/weight change. BMI is the ratio of weight to height (calculated with the equation weight (kg)/height (m²)). BMI gives an indirect measure of adiposity (or body fatness).

Waist circumference and waist-hip-ratio are both indirect measures of how much fat is stored around the waist, with higher values indicating a greater amount of fat. For all three measures, higher levels are generally linked to greater health risks. Few studies were found which looked at the effect of BMI change or weight change and the findings were not clear so we have not focused on these.

How many studies were included in the body weight review?

We analysed 226 studies from around the world, comprising more than 456,000 women with breast cancer including 36,000 who died, approximately 21,000 of breast cancer.

What were the findings of the review on body weight?

Our independent Panel of experts reviewed the evidence linking body weight and mortality outcomes after a breast cancer diagnosis and found strong evidence that having a higher body weight after a breast cancer diagnosis increased the risk of death.

What are the percentage risk changes?

For every 5-point (kg/m²) increase in BMI, the risk of dying of any cause was estimated to increase by 7%.

The risk of dying from breast cancer was estimated to increase by 10% and the risk of having a second primary breast cancer by 14% both for every 5-point increase in BMI (kg/m²).

Why can an increased body weight increase the risk of death after a breast cancer diagnosis?

The relationship between body weight and breast cancer at different stages of life is complex.

A number of plausible mechanisms have been reported that may explain the links between body weight, breast cancer development and death following a diagnosis of the disease. These include differences in the following between women living with obesity compared with those with a lower BMI:

- **Circulating oestrogen** (increased among women living with obesity)
- **Insulin resistance and insulin levels** (increased among women living with obesity)
- **Levels of systemic inflammation within the body** (increased among women living with obesity)
- **Adipokine levels** (including increased leptin, which is pro-inflammatory, and decreased adiponectin, associated with inflammation and insulin sensitivity among women living with obesity)

All of these factors are thought to interact in a way which increases the risk of breast cancer developing and may also be associated with poorer outcomes once diagnosed. Obesity may also alter disease characteristics, so that those living with obesity develop breast cancer that is less treatable and more likely to spread. Further studies exploring the mechanisms that underpin the links between body weight and breast cancer outcomes are much needed.

Should someone who's overweight with breast cancer lose weight?

Since there was limited evidence which specifically looked at the effect of reducing weight, it is difficult to know for sure. But the review supports the advice for women who have completed primary treatment for breast cancer to follow the WCRF/AICR Cancer Prevention Recommendations, which include maintaining a healthy weight. It may be unrealistic to reach a 'healthy weight' but any reductions in the level of overweight could be helpful. It is important that any efforts to change eating and physical activity to control weight fit with the specific medical advice given by the cancer management team.

Being a healthy weight also helps reduce the risk of other chronic diseases such as cardiovascular disease and diabetes.

Does someone with a higher body weight after a breast cancer diagnosis have a greater risk of dying?

The findings from this review show that there was a greater risk of dying with higher body weight and that this was the case for dying from any cause as well as dying from cancer specifically. The risks were greater for women living with obesity compared to those who were overweight. The relationship between body weight and risk of dying was more complex than this, with greater risks also seen at abnormally low body weights (BMI below 18).

What does the review mean for people who go through chemotherapy who are told that they need to keep the weight on?

There is a difference between somebody losing weight to try to get to a healthy weight and losing weight because they have a condition or disease that is causing them to lose weight. If a patient is losing weight involuntarily, and that is causing health concerns, then they need to talk to their doctor or dietitian about what they can do to keep the weight on.

Published papers

This review builds on WCRF International's previous work. It gives further insight into which diet, physical activity and body weight factors could affect a person's risk of death after a breast cancer diagnosis. The review and its findings are set out in much greater detail in the form of four academic papers as published in the International Journal of Cancer:

- [Post-diagnosis body fatness, recreational physical activity, dietary factors and breast cancer prognosis: Global Cancer Update Programme summary of evidence grading](#)
- [Post-diagnosis recreational physical activity and breast cancer prognosis: Global Cancer Update Programme systematic literature review and meta-analysis](#)
- [Post-diagnosis body fatness, weight change and breast cancer prognosis: Global Cancer Update Programme systematic literature review and meta-analysis](#)
- [Post-diagnosis dietary factors, supplement use and breast cancer prognosis: Global Cancer Update Programme systematic literature review and meta-analysis](#)

Author contributors

Global Cancer Update Programme team at Imperial College London, UK

Principal Investigators

Dr Doris Chan

Dr Kostas Tsilidis

Research team

Dr Teresa Norat

Neesha Nanu

Leila Abar

Katia Balducci

Margarita Cariolou

Rita Vieira

Dr Dagfinn Aune

Dr Georgios Markozannes

Dr Nerea Becerra-Tomás

Dr Darren C. Greenwood

University of Leeds, UK (*Advisor on statistics*)

Expert Panel

Professor Alan Jackson

University of Southampton, UK

Professor Anne McTiernan

Fred Hutchinson Cancer Research Center, US

Professor Ed Giovannucci

Harvard T.H. Chan School of Public Health, US

Professor Ellen Kampman

Wageningen University, NL

Dr Kostas Tsilidis

Imperial College London, UK

(*prior to becoming a principal investigator*)

Dr Marc Gunter

International Agency for Research on Cancer, FR

Professor Steven Clinton

Ohio State University, US

Vivien Lund

UK (lay member)

Expert Panel observers

Professor Amanda Cross

Imperial College London, UK

Professor Elio Riboli

Imperial College London, UK

Global Cancer Update Programme Secretariat

Deirdre McGinley-Gieser

Executive Vice President

American Institute for Cancer Research (AICR)

Dr Helen Croker

Head of Research Interpretation

and Head of CUP Global Secretariat

WCRF International

Dr Kate Aillen

Executive Director of Science and Public Affairs

WCRF International

Professor Martin Wiseman

Scientific and Medical Advisor

WCRF International

Dr Nigel Brockton

Vice President of Research

American Institute for Cancer Research (AICR)

Dr Panagiota Mitrou

Director of Research and Innovation

WCRF International

Dr Vanessa Gordon-Dseagu

Research Interpretation Manager

WCRF International

Nicole Musuwo

Senior Research Interpretation Officer

WCRF International

Global Cancer Update Programme

What is the Global Cancer Update Programme?

WCRF's Global Cancer Update Programme is the flagship research programme of the World Cancer Research Fund Network and provides a global analysis of scientific research into the link between diet, nutrition, physical activity, body weight and cancer. It is produced in partnership with American Institute for Cancer Research, World Cancer Research Fund in the UK and Wereld Kanker Onderzoek Fonds in The Netherlands.

Reviews undertaken within the Global Cancer Update Programme are updated on a regular basis and this evidence is assessed by a Panel of independent experts from across the globe. This gives the Panel the opportunity to assess if the scientific evidence has changed based on the most up-to-date findings and, therefore, if our Cancer Prevention Recommendations need to change. This process feeds into every part of WCRF International's and the WCRF Network's work.

What is the aim of the Global Cancer Update Programme?

The Global Cancer Update Programme is a comprehensive review of the evidence related to the impact that factors related to diet, nutrition, physical activity have upon cancer incidence and survival. It is funded by the WCRF Network, with the reviews undertaken by researchers from several universities including Imperial College London, Wageningen University (the Netherlands), Harvard (U.S), as well as other cancer-related organisations (IARC, France).

Once a review has been completed, WCRF International convenes a Panel of independent global experts to consider the results. The Panel then judges the evidence and draws conclusions on how strong the evidence is for each risk factor. This process enables WCRF International, and the wider scientific community, to consider the areas within which there is strong evidence – with the result that we can draw conclusions about which factors cause cancer and which might reduce the risk of the disease. We are also able to see areas where evidence is missing and, where appropriate, fund new research to fill in these gaps.

Why do you have the Global Cancer Update Programme?

As our knowledge and expertise continue to deepen, and we fund more and more pioneering work in the field, it's crucial our findings stay up-to-date. That's why we created Global Cancer Update Programme – the world's largest and most authoritative source of up-to-date scientific research on cancer prevention.

We carefully analyse this research so that society has access to world-leading cancer prevention and survival advice.

Wasn't it called the Continuous Update Project before?

Yes, this used to be called the Continuous Update Project (or CUP), but it has now gone through a transition as new priorities and research areas have moved forward. It is now called the Global Cancer Update Programme.

How do you judge the evidence?

- A team at Imperial College London conducts systematic literature reviews – gathering and presenting the available, scientific evidence from around the world.
- The International Agency for Research on Cancer provides expert reviews of the main hypotheses – related mechanisms to support the epidemiological evidence.
- A Global Cancer Update Programme Panel of independent experts evaluate and interpret the evidence, making judgements on the strength of the evidence and, where possible, the likelihood that the exposures studied increase, decrease or have no effect on the risk of cancer.
- The Panel makes Recommendations for the public based on its judgements.
- A WCRF/AICR Secretariat, responsible for day-to-day management of the programme, oversees the whole process and supports the work of the Panel.

[Find out more about the Global Cancer Update Programme here](#)



World Cancer Research Fund International's **Global Cancer Update Programme** is a global analysis of scientific research into the link between diet, nutrition, physical activity, weight and cancer. It is produced in partnership with American Institute for Cancer Research, World Cancer Research Fund in the UK and Wereld Kanker Onderzoek Fonds in The Netherlands.