



Nutrition & Well-Being
for healthy living



**Fondazione
Barilla**

il tuo cibo, la tua terra

people, environment, science, economy

THE BCFN CONTRIBUTION TO THE MAJOR ISSUES IN FOOD AND NUTRITION

The multidisciplinary analysis concerning the people, environment, economy and society has led to the definition of 4 specific lines of interconnected studies on the issues related to food and nutrition.



▶ FOOD FOR ALL

In the area Food for All, the Barilla Center for Food & Nutrition addresses the issues of access to food and of malnutrition, with the aim of reflecting on how to promote better governance of the global food system in order to make a more equitable distribution of food possible and to encourage a better impact on social welfare, health and the environment.



▶ FOOD FOR SUSTAINABLE GROWTH

With reference to the area Food for Sustainable Growth, the Barilla Center for Food & Nutrition aims to examine the issue of a better utilization of natural resources within the food chain. More specifically, the analyzes performed have allowed us to point out the weaknesses, to assess the environmental impact of the production and consumption of food and to formulate (a set of) proposals and recommendations concerning personal and collective lifestyles that can have a positive affect on the environment and natural resources.



▶ FOOD FOR HEALTH

In the Food for Health area, the Barilla Center for Food & Nutrition decided to start its research work by analyzing the relationship that exists between nutrition and health. It thoroughly analyzed the various recommendations made by the most authoritative scientific institutions in the world, in addition to the themes that emerged at different stages of discussion with the most qualified experts, thus providing civil society with a concise and effective overview of concrete proposals aimed at facilitating the adoption of a correct lifestyle and a healthy diet



▶ FOOD FOR CULTURE

In the Food for Culture area, the Barilla Center for Food & Nutrition described man's relationship with food. In particular, the BCFN wanted to retrace the most important steps along the path that have accompanied the development of the man-food relationship, bringing (through moments of comparison) the fundamental role of the "Mediterranean-ness" and its relevant dimensions to the center of attention.



THE VISION OF BARILLA CENTER FOR FOOD & NUTRITION

The Barilla Center for Food & Nutrition (BCFN) is a center of multidisciplinary analysis and proposals which aims to explore the major issues related to food and nutrition on a global scale. Created in 2009, BCFN intends to listen to the demands emerging from society today by gathering experience and qualified expertise on a worldwide level and promoting a continuous and open dialogue. The complexity of the phenomena under investigation has made it necessary to adopt a methodology that goes beyond the boundaries of different disciplines.

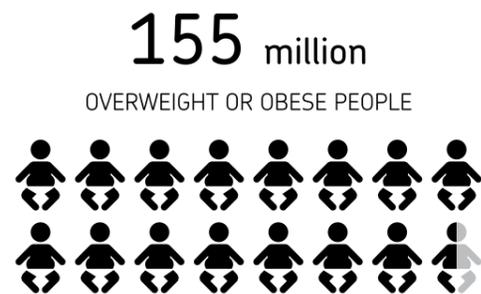
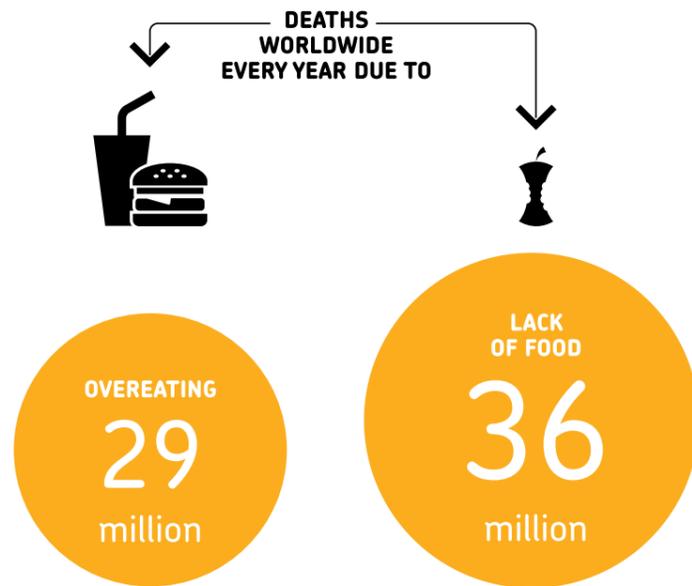
These topics under study are broken down into four areas: Sustainable Growth for Food, Food for Health, Food for All and Food for Culture. The areas of analysis involve science, the environment, culture and the economy; within these areas, BCFN explores topics of interest, suggesting proposals to meet the food challenges of the future.

THE CURRENT PARADOXES ON FOOD AND NUTRITION

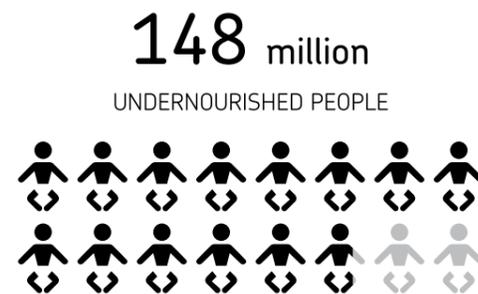
AN IN-DEPTH ANALYSIS OF THE GLOBAL SCENARIOS OF OUR TIME AND THEIR CONSTANT AND VERY RAPID DEVELOPMENT REVEALS A WORLD FILLED WITH STRIKING PARADOXES

EXCESS OF FOOD OR ACCESS TO FOOD?

In the world today there are more than 1 billion people suffering from hunger while there is an equal number who are suffering the consequences of over-nutrition, contracting serious metabolic diseases such as diabetes, for example. Yet, today the global food system is able to provide adequate nutrition for all the human beings on the planet. The causes of this situation are not easy to find and remove. This should act as a stimulus to identify and propose urgent and effective solutions

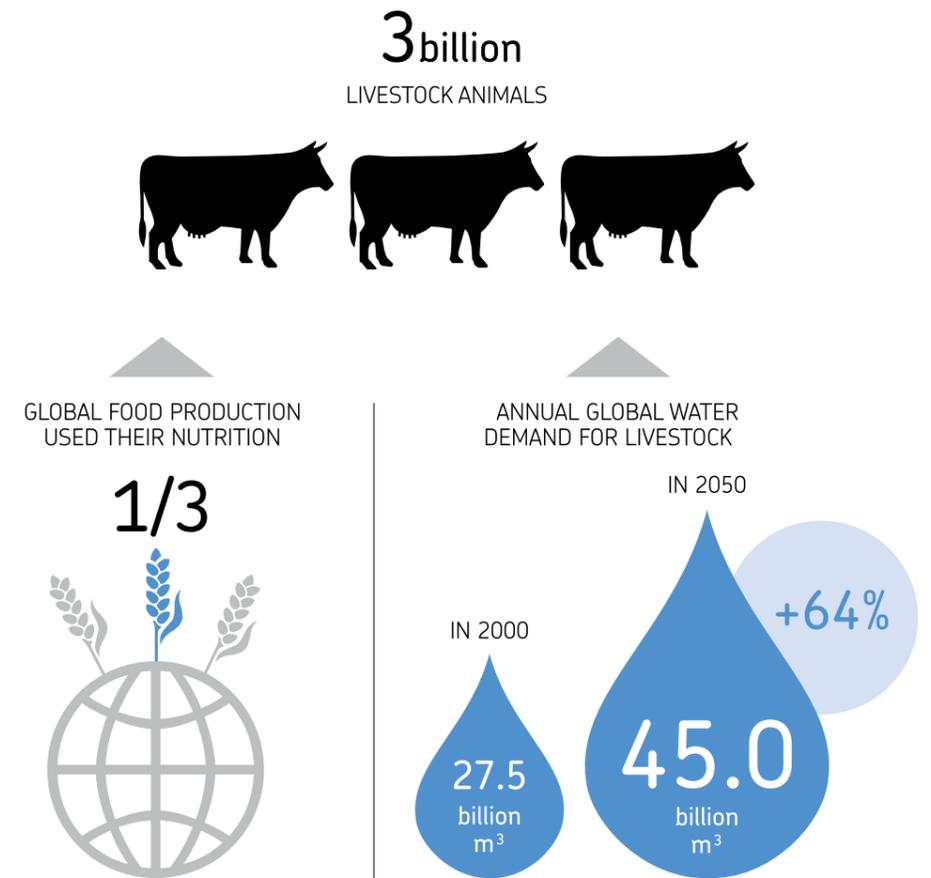


CHILDREN
For the first time in fifty years, the new generations will have a shorter life expectancy



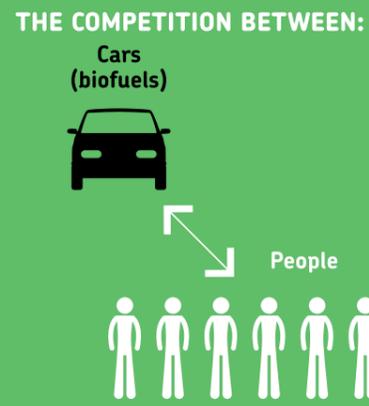
NOURISH PEOPLE OR ANIMALS?

There are about three billion farm animals on the planet. A third of the global food production is destined for their nutrition and these animals contribute significantly to climate change factors. In fact, it is estimated that they are responsible for at least 50% of the agricultural emissions

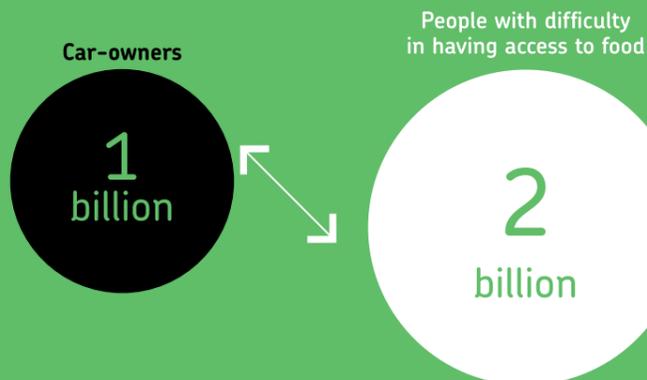


FEED PEOPLE OR CARS?

Another form of misuse of the resources of the Earth concerns the competition between biofuels and food. An increasing proportion of agricultural land is being used for the production of biofuel. In doing so, we are choosing to give water to our cars instead of food to human beings

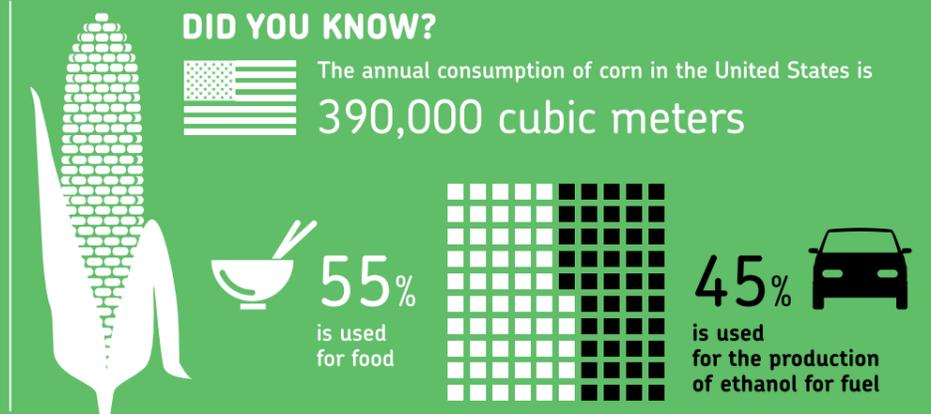


IS COMPETITION BETWEEN:



DID YOU KNOW?

The annual consumption of corn in the United States is 390,000 cubic meters



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Dear Reader,
For some years now, we have been studying the relationship between health, eating habits and lifestyles. The elaboration of the studies conducted has led us to evaluate these relationships at every stage of life: from the growth of children and adolescents to the greater longevity of adults.

Working on this updated and enhanced document, we have had further confirmation of how the relationships between nutrients, dietary behaviors and lifestyles have a preventive effect not only on the possible onset of major chronic diseases (including cardiovascular disease, diabetes and cancer), but also on the development of neurodegenerative diseases and osteoporosis, which are more common because of the increased longevity of life.

In carrying out the proposed analysis our goal, from the beginning, has been to translate the scientific evidence, which can be very complex, into nutrition and behavior recommendations that are easily accessible, even to non-specialists.

This important convergence of major international guidelines, accompanied by proposals for further development of research and policy on educational programs and the development of products that are increasingly consistent with the nutritional indicators, has resulted in a set of guidelines that contain and summarize what has been defined by the most important and authoritative scientific experts in the world.

Along with some suggestions, one fact has forcefully emerged from this: the adoption of a diet and a healthy lifestyle, able to positively influence well-being, is accomplished through simple everyday choices and behavior that we can gradually achieve without disrupting our lifestyles.

What we need to do is make little effort every day. In return, there is the prospect of a better and healthier life.

Enjoy your reading!

Guido Barilla
Guido Barilla
BCFN President

INTRODUCTION:
DIET AND HEALTH

INTRODUCTION: DIET AND HEALTH

Eating habits and lifestyles can significantly affect human health and the quality of life. This was the starting point and – at the same time – the culmination of the work that the Barilla Center for Food & Nutrition (BCFN) has been pursuing since its founding in 2009.

On the one hand, food shortages and malnutrition in many developing countries kill millions of people, especially children, every year. Nearly one billion people are currently hungry – or one out of seven people on the planet. On the other hand, especially in industrial and Western countries, overweight and obesity – among both children and adults – represent a serious and expensive public health problem.

In addition, since the second half of the twentieth century there has been a significant change in people's eating habits. Consumers, particularly in Western countries, are eating more sugar, fat, salt and processed foods instead of fresh fruits and vegetables and whole grains. This transition has been accompanied by a reduction in physical activity and an increase in the average caloric intake.

As a result, the onset of some chronic diseases – including obesity, type 2 diabetes, cardiovascular disease and certain kinds of cancer – has been increasing over the last few decades. In fact, non-communicable diseases present a greater risk to human health than infectious diseases, and also pose a huge socio-economic burden for society.

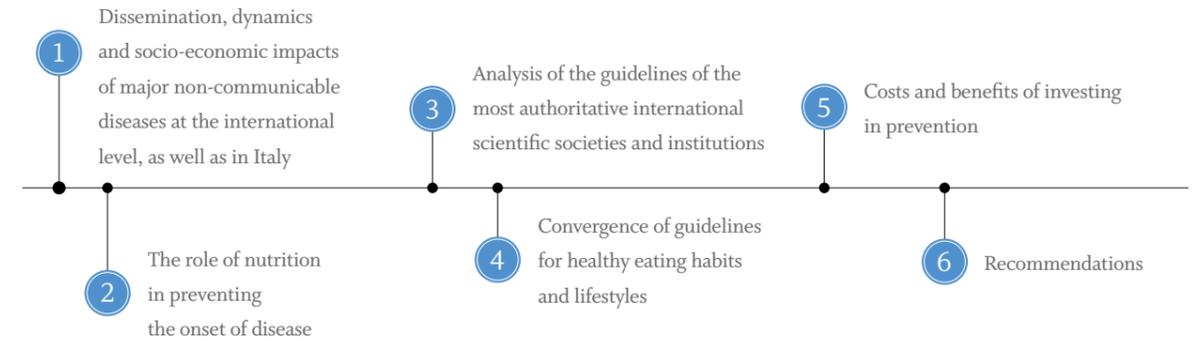
Research has clearly shown that unhealthy lifestyles and diet contribute to an increased risk of developing cardiovascular disease, diabetes, cancer and other diseases. Obesity, in particular, can increase an individual's risk of developing diabetes, hypertension and cardiovascular disease.

But eating better can directly translate into better health.

If companies and businesses continue, however, to produce unhealthy foods and consumers choose to eat those foods, human health and longevity will suffer. More than simple restraint is needed; ultimately, we need to find ways to grow and produce more nutrient-rich foods and increase physical activity. If we fail to accomplish these tasks quickly, future generations will experience worse health and die sooner than previous generations that preceded them, breaking the pattern of continuous human progress toward greater levels of well-being.

The BCFN's unique interpretative model uses these considerations to thoroughly analyze the impact of different food-related factors on human health. The following diagram summarizes the approach we have taken.

The analyses in Chapter 1 clearly demonstrate the increasing prevalence of non-communicable diseases worldwide, raising the question – how can rampant chronic disease, especially among young people, be curbed?



In chapter 2, we analyze the diverse and growing research about the role of diet and lack of exercise in cardiovascular disease, diabetes, cancer, neurodegenerative disease and osteoporosis.

Chapter 3 analyzes the different sets of international guidelines regarding healthy food and lifestyle habits for the prevention of major chronic diseases. We focused on the most common and serious diseases – cardiovascular diseases, diabetes and cancer. The guidelines for the prevention of these diseases, in many cases, are also the best dietary and behavioral indications for preventing the onset of neurodegenerative diseases, osteoporosis and other health problems.

By comparing these different guidelines from research institutes all over the world, we were able to find the similarities among the different approaches and produce a set of cross-cutting dietary and behavioral recommendations that, through the close relationship between food and lifestyle choices, represent a concise and practical tool for overall prevention of chronic diseases and good health.

Chapter 4 presents an analysis of how the most common models for diet adhere to the principles identified for healthy nutrition.

In Chapter 5, we attempt to quantify the practical impact of the adoption of these strategies, not only in medical terms, but also in economic and financial terms. As a result, we developed a simulation model that demonstrates the costs and benefits of following different diets and lifestyles.

Finally, in Chapter 6, we make concrete recommendations for consumers, nutritionists, health care practitioners and policy-makers to help improve healthy eating and lifestyle habits across the globe.

- Our objective is to *synthesize*, through extensive and rigorous scientific analysis, *all aspects that link diet to prevention of non-communicable disease*. While overall health and diet are inextricably linked, they are rarely studied and deserve more attention and research;
- We are certain that *the creation of this work has involved many of the most important and respected professionals in the field of medicine and prevention*, at both the national and international levels;
- And finally, our hope is to be able to *contribute concretely to the improvement and popularization of scientific knowledge regarding diet and health, and to develop effective prevention policies and influence individual behavior, to help generate real improvement in living conditions and health, present and future.*

Ultimately, we hope that this publication will persuade people to not only *eat well today to live better today, but to eat well today to live better and longer tomorrow.*

SIGNIFICANT CHANGE IN TIMING CONCERNING NUTRITION AND LIFESTYLE: REDUCTION OF PHYSICAL ACTIVITY AND AN INCREASE IN THE AVERAGE AMOUNT OF CALORIES CONSUMED

FUTURE GENERATIONS WILL EXPERIENCE LIVING CONDITIONS WORSE THAN THOSE OF THE GENERATIONS THAT PRECEDED THEM

EAT WELL TODAY TO LIVE BETTER AND LONGER TOMORROW

1. SCENARIO OF REFERENCE



1.1 POPULATION TRENDS: A GROWING POPULATION THAT IS GETTING OLDER AND OLDER¹

IN 2025, THERE WILL BE MORE THAN 8 BILLION PEOPLE IN THE WORLD AND A "POPULATION SHIFT" HAVING A SHARP INCREASE IN THE POPULATION BETWEEN 50 AND 60 YEARS OF AGE IS EXPECTED

According to the United Nations, by 2025 there will be more than 8 billion people living on the planet and by 2050, the world population is expected to reach 9 billion people. As the population increases, it is also becoming older. A population shift is occurring, with the number of people between 10 and 14 years of age diminishing between 2000 and 2020, while the population of people between 50 and 60 will increase sharply. Worldwide, the ratio of childhood dependency – the ratio between the number of people from 0 to 14 years and people between 15 and 64 years – will decrease from 0.472 in 2000 to 0.374 in 2020; at the same, senile dependency, or the relationship between the population over 65 years of age and the population between the ages of 15 and 64, will grow from 0.110 in 2000 to 0.145 by 2020.

In Italy, the population has grown slowly for decades and after having reached a peak in the decade of 2000-2010, the growth trend has begun to slow down again. Estimates indicate that the average annual growth of the population between 2020 and 2030 will be less than 0.1%. The share of working age people, or people between the ages of 15 and 64, which has been decreasing slowly for many decades, will see a further reduction of 4.5%. This is equal to approximately 1.8 million people; in 2030, approximately 31 million people will be more than 50 years of age, 19 million more than in 1980.²

There are significant differences between population growth in industrialized countries, where there is now almost zero point growth, and population growth in developing countries. In fact, 90% of the population growth occurring today is taking place in developing countries. While the number of births and deaths is nearly equal in many industrialized countries, in poor and emerging countries population rates continue to increase.

Currently, Italy, the United States, Canada, Australia, New Zealand, Japan and South Korea are experiencing decreases in mortality because of improvements in health and sanitation over the last century; at the same time, these countries also have had sharp declines in birth-rates over the last 50 years. In many developing countries, including sub-Saharan Africa, the Middle East and Southeast Asia, however, mortality is decreasing while the birth rate is still high and the average lifespan is increasing. Positioned in an intermediate situation between industrialized and developing countries are the Latin American countries, China and India. Closely related to these dynamics, thanks to global economic growth and the progress of science and medicine, is a general improvement of living conditions, with an average life expectancy worldwide³ that has been steadily increasing since the beginning of the century. Average life expectancy, in 2010, was 70.14 years of age for women and 65.71 for men. World life expectancies between 1950 and 2030 are highlighted in Figure 1.1.

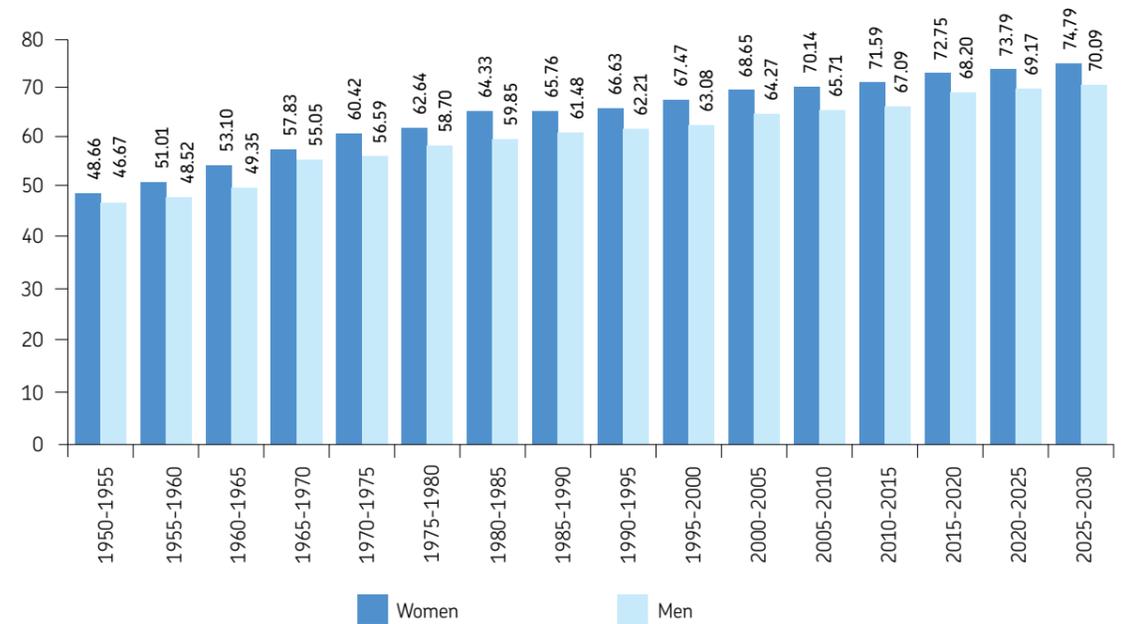
It is important to keep in mind, however, that there are countries with rapid growth in life expectancy, but that do not have sufficient conditions for their economic and social development.

In Bangladesh, for example, male life expectancy in 2020 will reach 71 years of age, only 3 years less than in Europe, despite being a country of partial suffrage, with inadequate sanitary facilities and great difficulties in finding primary drugs.

Growing world life expectancy is driven by high life expectancy rates in Western countries and the high rates of growth in life expectancy experienced by emerging economies. A selection of ten OECD countries with the highest life expectancy rates is shown in Figure 1.2.

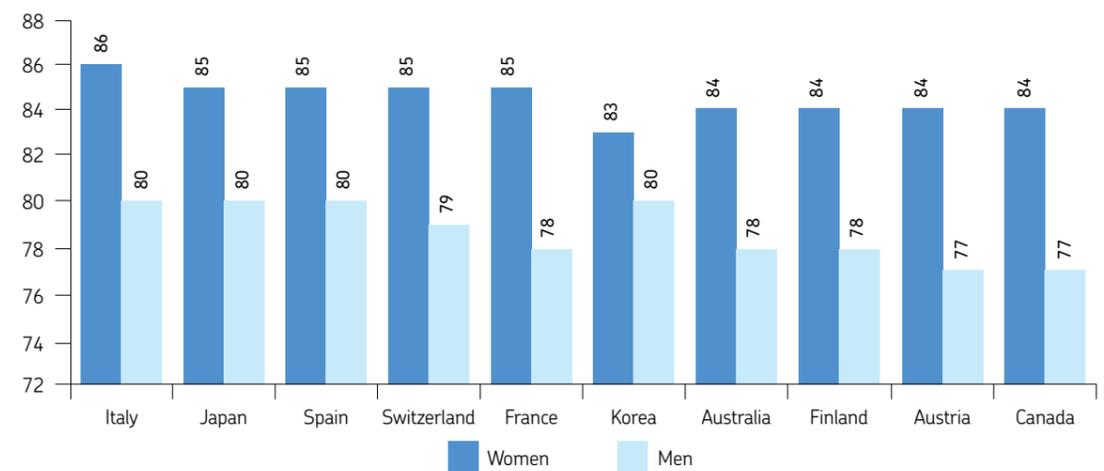
Figure 1.2. shows the ten OECD countries with the highest life expectancy in 2010: five of them are Asian, followed by Australia and Canada.

Figure 1.1. Worldwide life expectancy, comparison of male and female populations (1950-2030)



Source: elaboration by The European House-Ambrosetti of UN data (World Population Prospect, 2010).

Figure 1.2. Life expectancy in the top ten OECD countries, comparison of male and female populations (2010)

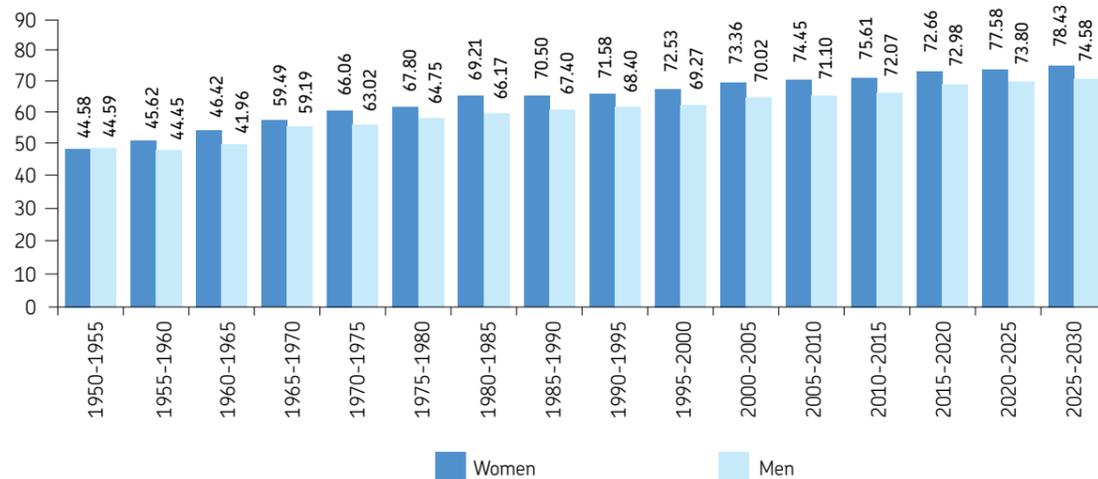


Source: elaboration by The European House Ambrosetti of OECD data, 2010.

The United States is unique among developed countries because it is beginning to experience a decline in life expectancy at birth in some states. A recent study found,⁴ in fact, that in Mississippi, Arkansas, Kentucky, Tennessee, Oklahoma, Alabama and Louisiana there is a progressive decrease in life expectancy, especially among women. Obesity and tobacco use among women is also high in these states. In Mississippi, the state with the highest obesity rate, life expectancy is only 67 years of age for men and 74 for women, much lower than many of the developing countries shown in Figure 1.2.

Figure 1.3., instead, shows that China has almost doubled life expectancy between 1950 and 2011. This will result in a rapidly aging population, also accelerated by the effects of the one-child policy adopted in China starting in 1979.

Figure 1.3. Life expectancy in China, comparison of the male and female populations (1950-2030)

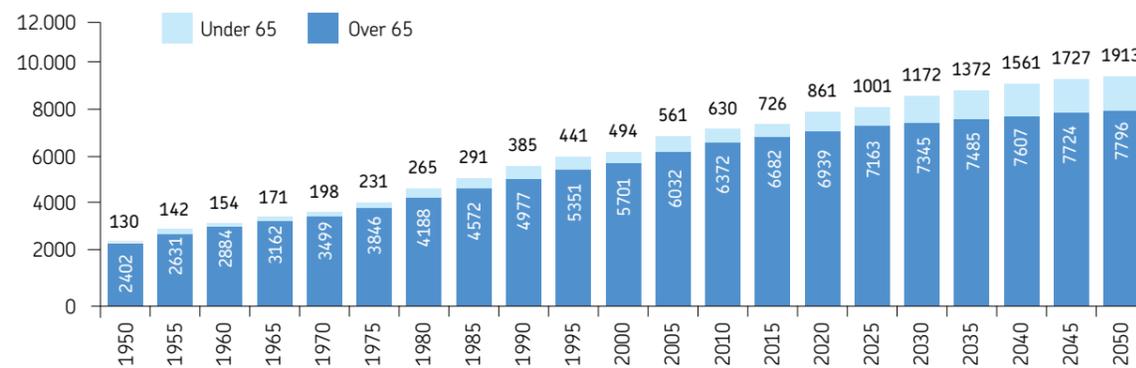


Source: elaboration by The European House Ambrosetti of UN data (*World Population Prospect*, 2010).

BY 2050, ONE-THIRD OF THE POPULATION IN INDUSTRIALIZED NATIONS AND A FIFTH IN THE DEVELOPING NATIONS WILL BE 60 YEARS OF AGE OR OLDER

The combined result of all these trends is the gradual and general aging of the population, a phenomenon that is now common both in industrialized and developing countries. According to the United Nations, by 2050 one-third of the population in industrialized nations and a fifth in developing countries will be aged 60 or over. Figure 1.4. illustrates the global population aged under 65 and over 65 between 1950 and 2050.

Figure 1.4. Composition of the global population aged under 65 and over 65 (1950-2050, millions of people)

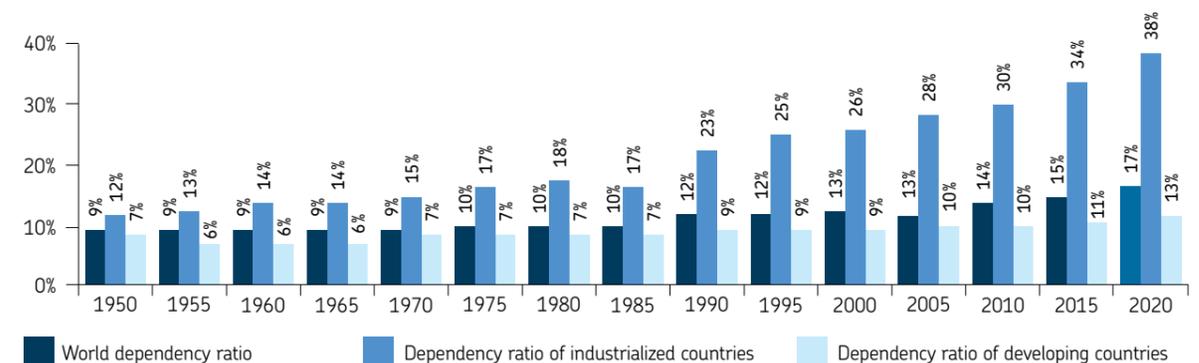


Source: elaboration by The European House Ambrosetti of UN data (*World Population Prospect*, 2010).

Figure 1.4. also shows how the global elderly population increased by 13% between 1950-2010. By 2050, the population of people over 65 will be 1.9 billion.

This phenomenon will have significant impacts on the economic, political and social structure of the world. An increase in the proportion of the population over 65 years of age will likely lead to a decrease in economic activity. As a result, the older population will become increasingly dependent on the younger population. Europe has the highest dependency ratio in the world and it will grow even more, reaching 48% in 2050. This increase is not only due to the increase in the number of elderly, but also to a declining population of people of working age, or between 15 and 64 years of age. Figure 1.5. compares the population of people over age 65 to the working age populations between 1950 and 2010. Both industrialized countries and those in the developing world will face similar challenges regarding pensions and health care. Because of global aging and the higher incidence of chronic diseases, the cost of care and medical equipment will increase. In China, for example, there will be a sharp increase in pension costs that will likely reach US\$160,000 billion by 2050.⁵

Figure 1.5. Ratio of the over 65 and working age populations worldwide (15-64 years, 1950-2020)



Source: elaboration by The European House Ambrosetti of UN data (*World Population Prospect*, 2010).

Figure 1.5. shows a sharp increase of the old-age dependency ratio in developed countries compared to that in developing countries, where the rate has remained substantially unchanged over the past 60 years: this phenomenon is due to the marked aging of the population in industrialized countries.

The United Nations predicts that the old-age dependency ratio will rise, worldwide, from the current 11.5% to 25.4% by 2050. Without further changes in other key parameters, the rapid aging of the population will lead to increasing demand for healthcare and assisted living centers and improved insurance and pension services. Moreover, chronic diseases are now the leading cause of death worldwide, and between 2005 and 2015 it is expected that deaths from such diseases will increase by 17%.⁶

THE RAPID AGING OF THE POPULATION WILL LEAD TO AN INCREASE IN THE DEMAND FOR PENSION BENEFITS AND ASSISTANCE FOR LONG-TERM CARE

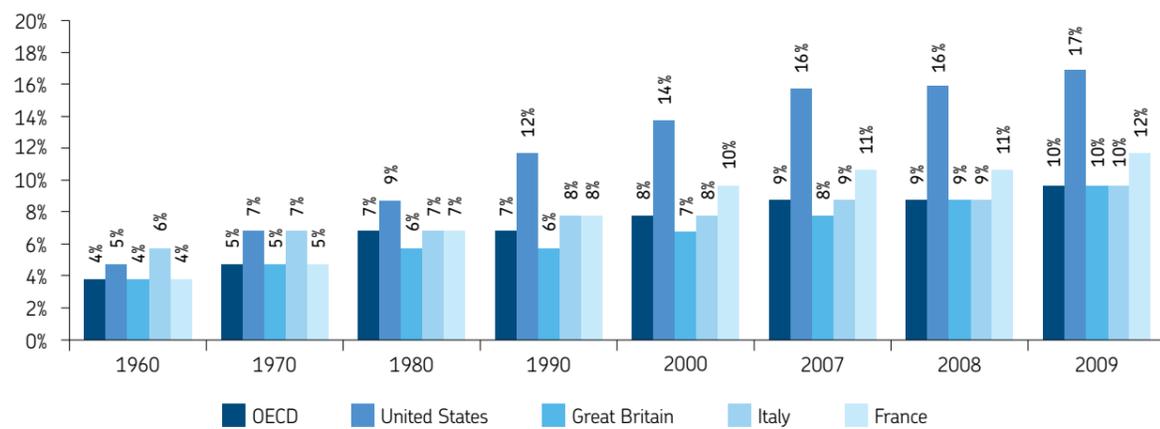
Increase in healthcare costs

The number of elderly people in the world involves a major expansion of healthcare spending, both public and private.

Figure 1.6. shows the growth of the GDP share devoted to health spending on average in OECD countries and France, Italy and the United States. In the United States, 17.4% of the GDP, approximately US\$2,500 billion is currently used for health care, compared to 5% in 1960. Italy and France are also experiencing a phenomenon of growth, albeit more

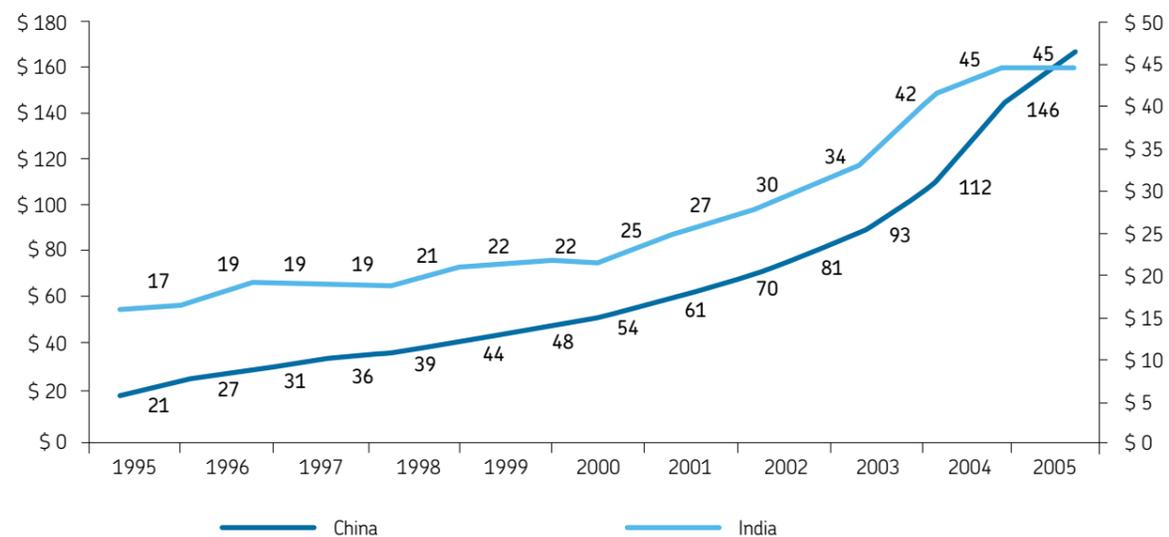
modest, with a rise from 6% of the GDP spent on healthcare in the 1960s to 10% today (approximately €180 billion) in Italy and 11.7% in France. China and India also show large increases in health spending per capita.

Figure 1.6. Share of the GDP used on total healthcare expenditure (1960-2010)



Source: elaboration by The European House Ambrosetti of OECD data, 2009.

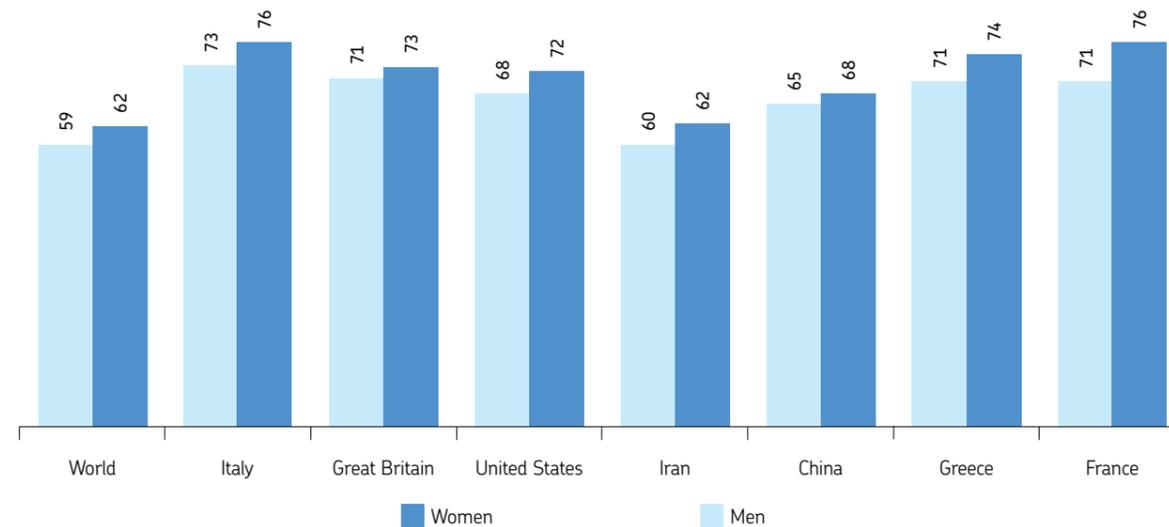
Figure 1.7. Total health expenditure per capita in dollars in China and India (1995-2009)



Source: elaboration by The European House Ambrosetti of OECD data, 2009.

The challenge for the upcoming years, globally, will be to find ways to pay for the costs associated with a graying population, through *active aging* programs. These programs can provide older people with greater involvement in economic and social activities, especially among age groups in the population considered more advanced and potentially unproductive. This can be achieved by increasing the years of life lived in good health. Figure 1.8. shows that countries with higher healthcare costs are also those that can provide citizens with a higher life expectancy in good health.

Figure 1.8. Life expectancy in good health in selected countries and compared to the global data (2010)



Source: elaboration by The European House Ambrosetti of WHO data, 2009.



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1.2 THE MAJOR NON-COMMUNICABLE DISEASES: EVOLUTION AND SOCIAL-ECONOMIC IMPACT

In the following section, we will present the latest data available in the literature relating to the dissemination, mortality and socio-economic impact of major diseases. Onset of these diseases is associated, with varying intensity, to diet:

- Diabetes and metabolic syndrome;
- Cardiovascular diseases;
- Cancer (tumors).

The main data will be presented relating to two other diseases whose onset appears to have more or less direct links with nutrition and lifestyle, and these diseases are mostly related to the more advanced stages of life:

- Osteoporosis;
- Neurodegenerative diseases.

Before describing in detail the scenario of diseases under consideration, below is an overview of the phenomenon of obesity and overweight conditions, which represent a major risk factor for the onset of all these diseases. Because obesity has experienced a substantial increase in its prevalence among the young, it also has a significant impact on health in adulthood and old age.

1.2.1 Obesity and overweight conditions

AN INCREASE IN OBESITY HAS BEEN REGISTERED IN EVERY COUNTRY IN THE WORLD: IN CHINA, THE PHENOMENON IS EXPLOSIVE

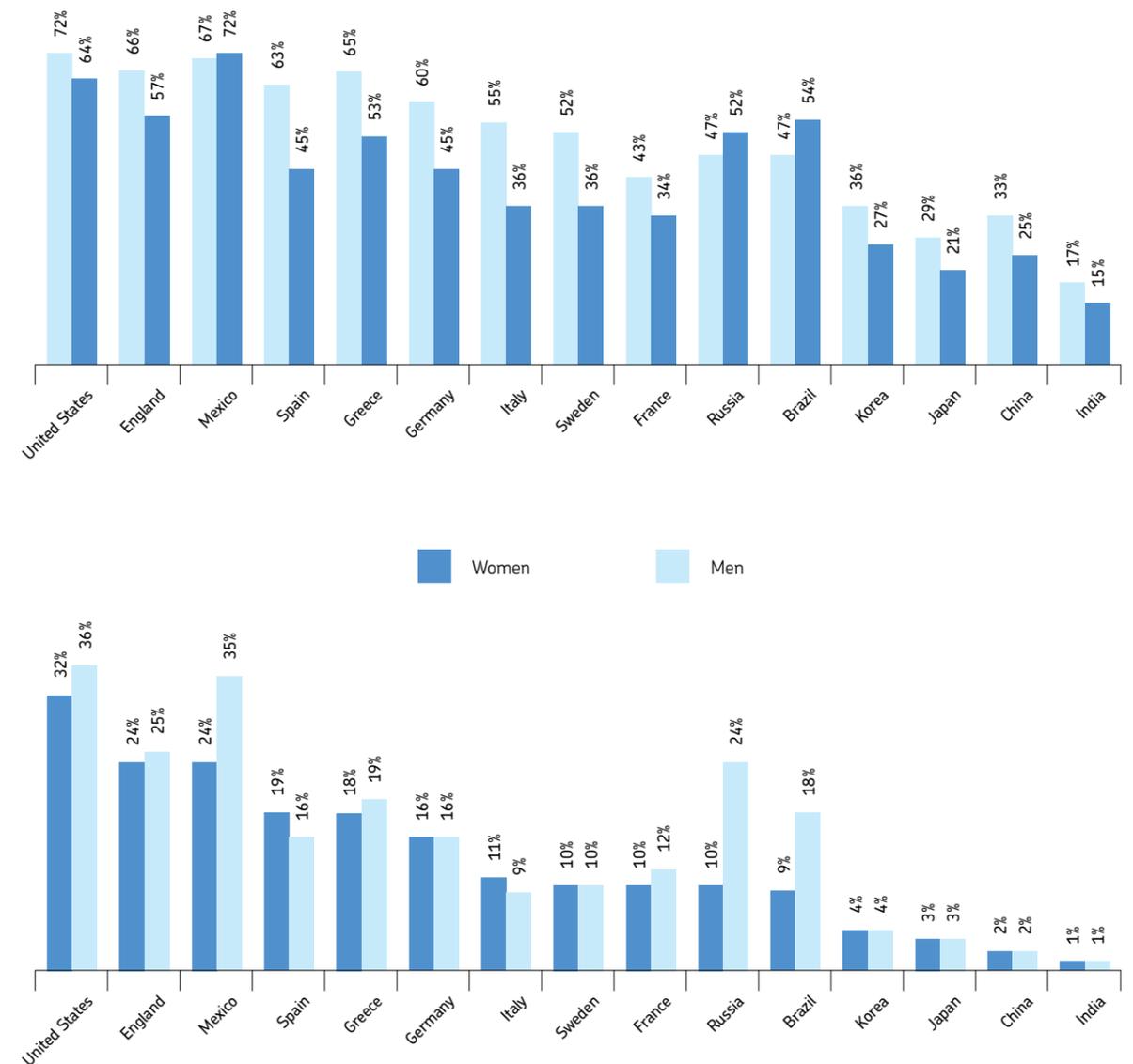
IN 2009, 100 MILLION CHINESE PEOPLE WERE OBESE AND 310 MILLION WERE OVERWEIGHT: A GROWING TREND SINCE 2004

Globally, most countries are experiencing an exponential growth of overweight conditions and obesity in people. The European Association for the Study of Diabetes (EASD) has even acknowledged that obesity is “the most important public health problem worldwide.”

Figure 1.9. clearly shows that the United States has the highest proportion of obese people in the world:⁷ in fact, approximately 34% of the adult population (more than 60 million people) seems to be within the criteria established to define obesity.

Asian countries are witnessing an expansion of the phenomenon, but with much lower rates (3% of the adult population in Japan and 4% in South Korea are obese). The trend in China, however, is worrisome due to its rapid growth: in 2004, there were 60 million obese Chinese and 200 million were overweight, while in 2009, the numbers rose to 100 million obese and 310 million overweight people. Also, according to the statistics of the OECD, which conducted a survey on a sample of the population who declared they were obese, the phenomenon is growing even in Europe: in the eurozone, the proportion of obesity increased from 6.6% in 1978 to 13.4% in 2010 (about 70 million people). The European countries most affected are Hungary with 19.5% of its population obese, Greece with 18.1%, Germany with 14.7%, and France with 11.2%.

Figure 1.9. Overweight (Figure 1) and obesity (Figure 2) in some countries (2008, % of the adult population)



Source: elaboration by The European House-Ambrosetti of *Obesity and the economics of prevention*, OECD data, 2010.

It has been well established by now that the rate of obesity increases along with increases in per capita income. In rich countries, however, the poorest people are the hardest hit by this disease because of the high costs of and difficult access to a healthy and varied diet. Moreover, in high-income countries, overweight conditions and obesity no longer appear as common phenomena mainly in adults and in middle-aged subjects; these diseases are found with increasing frequency in young children as well and the situation is only getting worse. Overweight conditions among the young can result in a higher probability of developing other serious illnesses in adulthood. In particular, type 2 diabetes was once considered a disease typical of older adults, while today it is increasingly reported among children and young people.

1.2.2 Diabetes and metabolic syndrome

Diabetes is one of the most widespread chronic diseases in the world, particularly within highly industrialized countries, and it is one of the most significant and costly social ills of our time because it is chronic and now afflicting people at a younger age.

The causes of the diabetes epidemic can be found in four main factors:

- The proliferation of bad eating habits;
- The growth in the number of overweight and obese people worldwide;
- Increasingly sedentary lifestyles;
- The aging of the population.

BETWEEN THE AGES OF 20 AND 79, THE PREVALANCE OF THE DISEASE IS ESTIMATED TO BE 5.9%, AMOUNTING TO 302 MILLION PATIENTS, WITH A 34% INCREASE COMPARED TO 2003

In 2009, it was estimated that among persons aged between 20 and 79 years worldwide, there was a 5.9% prevalence of the disease, amounting to 302 million patients, a 34% increase compared to 2003. Every year, there are more than 7 million new cases of diabetes recorded in the world (or one every 5 seconds).

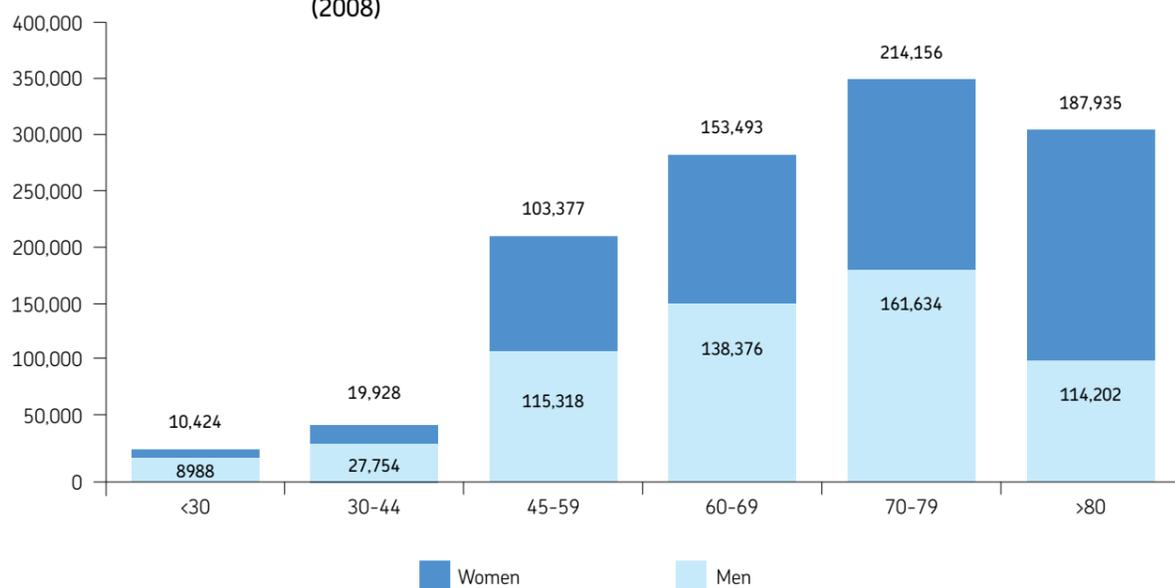
The prevalence of diabetes is expected to increase in both industrialized countries and developing countries. In China, for example, it is estimated that in 2007, there were approximately 39.8 million people with diabetes, or 4.3% of the country's population; by 2025, this number is expected to reach just under 60 million, or 5.6% of the population, with a 50% increase in the number of cases.

In India, the rise in the number of people with diabetes is even more worrisome. Currently, there are 40.8 million patients, or 6.2% of the population with diabetes, and that number is expected to reach 69.8 million, or 7.6% of the population, by 2025.

In Europe, the number of people with diabetes between 2000 and 2030 will grow by 30.5%, approximately 14.6 million more patients than today. In France, diabetes rates are especially high and by 2030 there will be 1 million new cases of the disease.

Unfortunately, the prevalence of and mortality from diabetes is growing dramatically with the increase in age of the population. Figure 1.10. shows the distribution by age of the deaths due to or caused (with various complications) by diabetes.

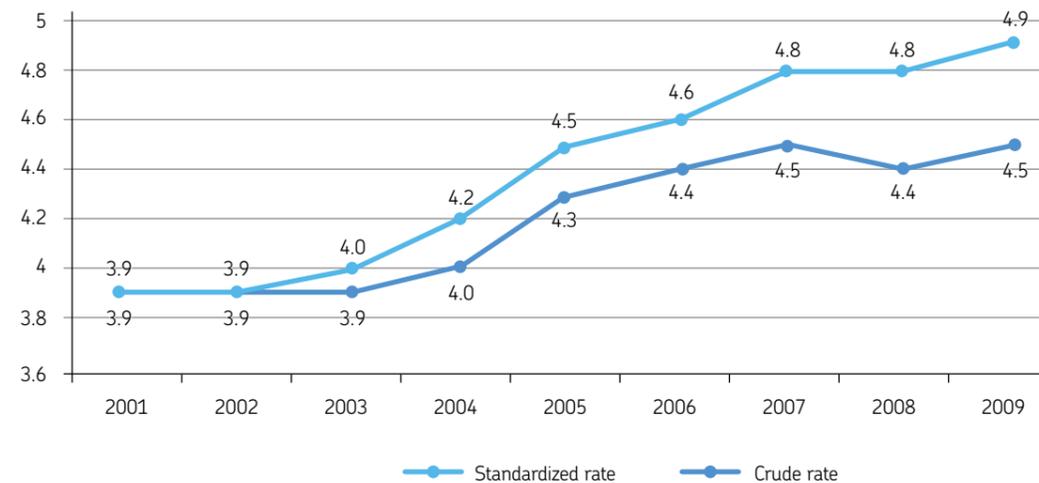
Figure 1.10. Absolute mortality from diabetes according to age groups worldwide (2008)



Source: elaboration by The European House Ambrosetti of WHO data, 2010.

In Italy, the prevalence of diabetes over the last ten years has been growing steadily. Diabetes rates in the country increased from 3.9% in 2001 to 4.9% in 2010, while the age-standardized rate rose from 3.9% to 4.5%.⁸

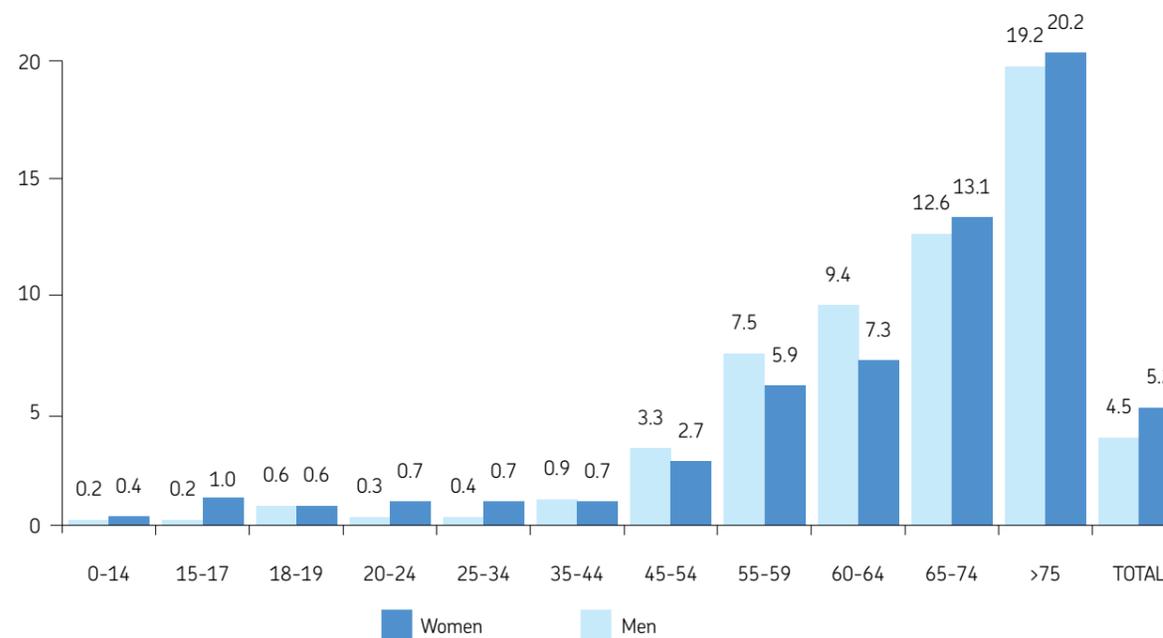
Figure 1.11. Trend of the prevalence of diabetes in Italy (2001-2010, % of the total population)



Source: elaboration by The European House-Ambrosetti of ISTAT/ISS data, 2010.

Also with regard to Italy, the data clearly shows that the prevalence of diabetes increases with age, reaching up to 19.8% in people aged 75.

Figure 1.12. Prevalence of diabetes as to gender and age group (2010)



Source: elaboration by The European House-Ambrosetti of ISTAT/ISS data, 2010.

Economic and social impacts

There have been numerous studies worldwide that estimate the economic costs associated with diabetes.

According to the International Diabetes Federation (IDF), in 2007 US\$232 billion dollars were spent worldwide for the treatment and prevention of diabetes and its associated complications. This expenditure is expected to reach at least US\$302 billion by 2025.

A 2007 study by the American Diabetes Association,⁹ found that the cost of diabetes in the United States in 2007 was US\$174 billion, a figure that includes US\$116 billion for direct medical costs and US\$58 billion in lost productivity of patients suffering from diabetes, as well as for the family members involved in taking care of them. Diabetics in the United States incur, on average, costs of over US\$11,400 a year, US\$6,650 of which is directly attributable to treating diabetes.

In Italy, the management of diabetes and its associated complications, including renal and cardiorespiratory failure and neuropathic and vascular lesions of the lower extremities, accounts for 7% of the national public health expenditure, or €7.7 billion a year.

The annual average cost per capita of a diabetic patient in Italy is approximately €2,600; hospital costs account for 54% of total costs, while the drugs used to treat diabetes account for 16% of total costs. The number of hospital admissions in Italy related to diabetes and its complications, including stroke, myocardial infarction, renal failure and amputation of lower limbs, is 75,000 patients per year. The cost of healthcare delivered to a diabetic patient increases 3 to 4 times, in the event of major complications.

1.2.3 Cancer (Tumors)

Cancer is the second biggest cause of death in the world. In Europe and Italy, cancer is steadily increasing, even though a reversal of the trend has been observed since 2005 in the case of men and there has been a slight slowing of an increase in women. Because this is a disease that mostly occurs in old age, the increase in the life expectancy of individuals is playing an important role in increasing its spread.

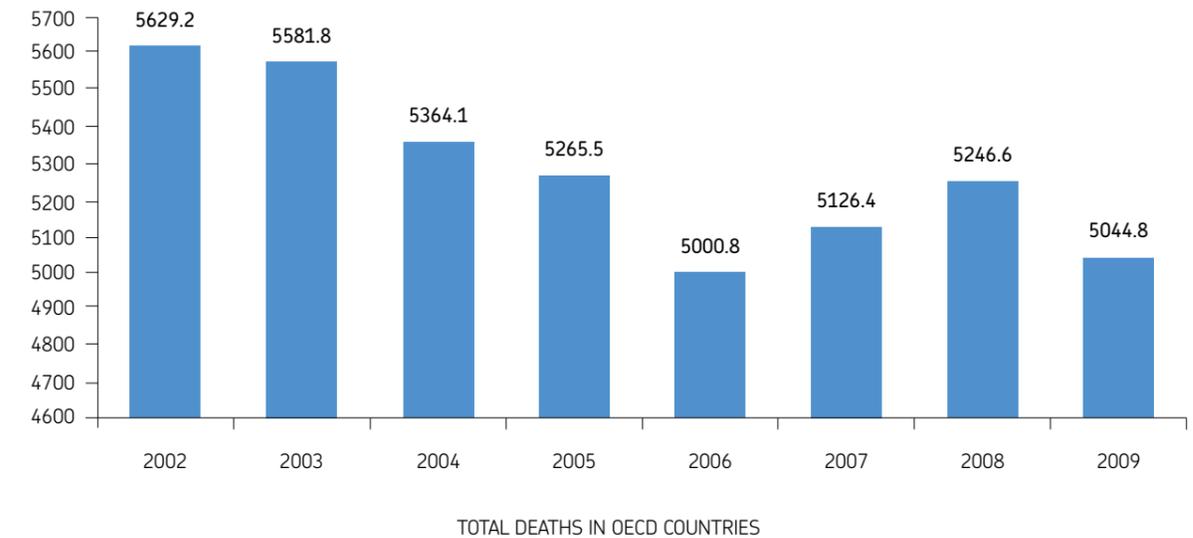
In addition to the population factor, the frequency of the disease is generally higher in developed countries. Only in the most advanced and richest societies is there investment of important resources for the health of the population, helping to identify ways of reducing the risk and prolonging the life expectancy of people who experience the disease. Figure 1.13. shows that in recent years there has been a downward trend in the number of deaths caused by cancer: today, in fact, in the most economically advanced countries, more than 50% of people who have been diagnosed with cancer are able to resume their lives after treatment.

Despite the downward trend in mortality, there is an increase in the cases of cancer in high-income countries, including France, where approximately 64,000 additional cases were registered between 2002 and 2008, and the United States, with an increase of about 5,000 cases during the same period.

In contrast, in low-income countries, the risk of death from cancer is much higher. According to the World Health Organization (WHO), in 2007 there were 7.9 million deaths in the world that could be traced to some form of cancer,¹⁰ three-fourths of these cases were located in developing countries.¹¹ Worldwide, one out of 8 deaths is due to cancer, and cancer causes more deaths than AIDS, tuberculosis and malaria combined.

By 2020, nearly 2 million people in Italy will have had a diagnosis of cancer during their lifetime: of these, approximately 400,000 will be patients less than two years after their

Figure 1.13. Evolution of absolute mortality/per 100,000 inhabitants from cancer in OECD countries



Source: elaboration by The European House Ambrosetti of OECD data, 2010.

diagnosis. These patients require intense medical care to treat their disease; 700,000 cancer patients will be in remission for 10 or more years. Although these patients are cancer-free, they will potentially suffer physical, psychological or social consequences of their treatments. These numbers are likely to increase over the next decades.¹²

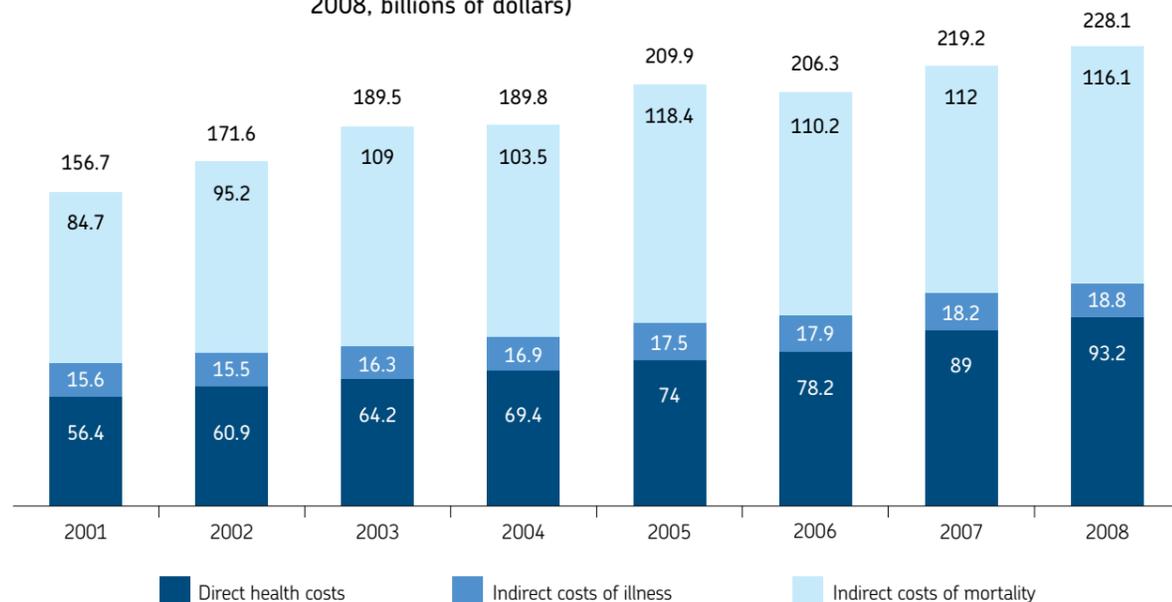
Economic and social impacts

The economic impact of cancer is very high and can be measured by direct health costs, including treatments, hospitalization and rehabilitation, as well as indirect costs, which include lost productivity because of the disease (indirect costs of morbidity) and the social cost of the loss of a job and premature death (indirect costs of mortality).

In the United States, for example, the National Institute of Health estimates that, in 2008, the economic impact of cancer amounted to more than US\$228.1 billion per year, including healthcare expenditures and loss of productivity.¹³ Specifically, direct health costs amounted to US\$93.2 billion, indirect costs of morbidity totaled US\$18.8 billion, and the indirect costs of mortality totaled US\$116.1 billion. Figure 1.14. highlights how total costs associated with cancer have been growing dramatically over the last 50 years. Direct health costs, in particular, have increased (in 1963, this value was US\$1.3 billion; in 1980 it had risen to US\$13 billion; in 1990, to US\$27.5 billion; in 2000, it was US\$55 billion; and finally, in 2008, it reached US\$93 billion).

THIS DISEASE CAUSES MORE DEATHS THAN AIDS, TUBERCULOSIS AND MALARIA COMBINED

Figure 1.14. Trend of the economic impact of cancer in the United States (2001-2008, billions of dollars)



Source: elaboration by The European House-Ambrosetti of American Cancer Society data (*Cancer Facts&Figures 2009* and previous editions).

In Italy, direct health costs for cancer treatment were €6.7 billion in 2004, or 6.6% of the country's total health expenditures.

Finally, the assistance of the cancer patient in the terminal phase of the disease has a significant physical, psychological, social and economic impact on family members. According to an investigation conducted by the Italian Survey of the Dying of Cancer (ISDOC),¹⁴ in approximately 40,000 Italian families each year, a family member must reduce their work hours or leave their own job to assist another member of the family.

1.2.4 Cardiovascular diseases

DISEASES OF THE CARDIOVASCULAR SYSTEM ARE THE LEADING CAUSE OF DEATH IN ALL THE DEVELOPED COUNTRIES: IN 2008, IT ACCOUNTED FOR 30% OF ALL DEATHS

Diseases of the cardiovascular system¹⁵ are the primary cause of death in all industrialized countries; this often disabling illness is bound to become more widespread because of the progressive increase in life expectancy.

The main risk factors of cardiovascular disease are related to unhealthy lifestyles, such as smoking tobacco, little physical activity, high levels of cholesterol and high blood pressure, type 2 diabetes and abdominal obesity, and are partially due to an incorrect diet (the simultaneous presence of two or more factors increases the risk of incurring ischemic heart disease and cardiovascular accidents).

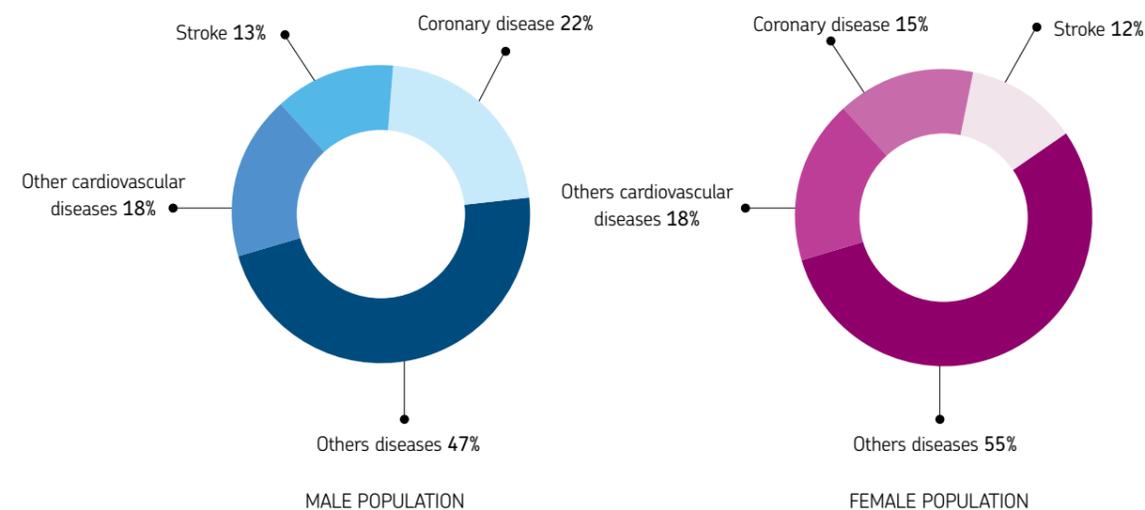
According to WHO,¹⁶ there were 17.3 million deaths from cardiovascular disease worldwide in 2008, equal to 30% of all deaths. Of these, 7.2 million were due to heart diseases and 6.1 million to ictus.

While cardiovascular diseases were once considered illnesses that only affected industrialized countries, today 80% of the deaths from cardiovascular disease occur in developing or emerging economies.

Heart disease and those of the circulatory system are the main causes of death in Europe – more than 4.3 million deaths every year. Almost half of the deaths are caused by cardiovascu-

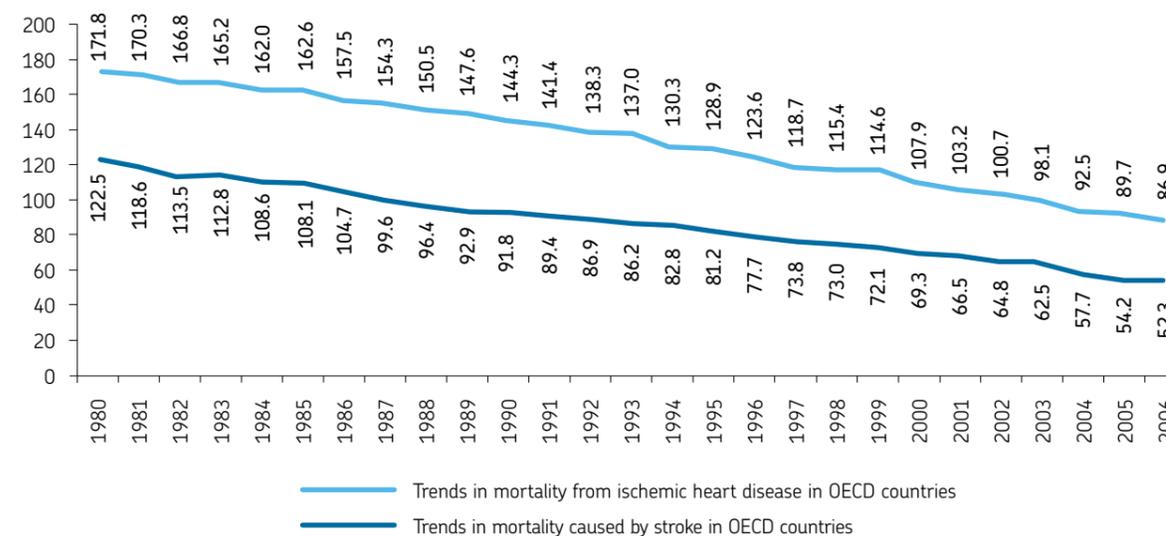
lar disease – 54% of women and 43% of men – of these, a little less than half of the cases are due to myocardial diseases and one-third are due to heart attack. Over the last decade, deaths from cardiovascular disease have dropped in most Western countries, and France and the United States show an annual average reduction of mortality of 2.8% and 3.6%, respectively. Although the number of deaths is still quite high, there has been a drop in comparison to the previous years and, in particular, between 1995 and 2005 there was a reduction of the number of deaths by an absolute value of 9.6%, while the standard death rate¹⁷ dropped 26.4%. Estimates from a report on population changes and cardiovascular diseases during the period from 1950 to 2050 indicate that mortality from cardiovascular diseases in the

Figure 1.15. Proportion of deaths caused by cardiovascular diseases in Europe (2008)



Source: elaboration by The European House Ambrosetti of European Cardiovascular Disease data, 2008.

Figure 1.16. Trend of deaths due to ictus and ischemic heart diseases in OECD countries (1980-2006)



Source: elaboration by The European House Ambrosetti of OECD data, 2008.

United States may increase over the period from 2000 to 2030.¹⁸ This latest analysis suggests the need for strong interventions for prevention of the disease at the beginning of this century.

Economic and social impacts

The treatment of cardiovascular diseases implies, on the average, rather high health costs, particularly due to the hospitalization of patients in the acute phase of their illness, the administration of drugs, rehabilitation and home assistance.

In addition, such diseases generally result in chronic health conditions for the patient and are one of the main causes of infirmities of long duration and the abandonment of work.

The most recent estimates of the total cost of cardiovascular diseases indicate an impact of US\$286.6 billion for the year 2010. This value includes both the direct health costs (hospital services, drugs, assistance at home, etc.) and the indirect costs calculated as a loss of work productivity due to the illness or premature death of the patients.

The spread of cardiovascular diseases brings heavy economic and social repercussions, not only in industrialized countries, but also in those that are developing, including China. According to recent estimates by WHO, the impact of heart diseases, ictus and diabetes, from 2006 to 2015, will result in a loss of national income for China equal to US\$558 billion.

The total economic impact of cardiovascular diseases in Europe in 2006 amounted to approximately €192 billion;¹⁹ this value corresponds to an average total cost per capita of €391. In particular, the costs of coronary artery diseases amount to €49 billion per year (approximately one-fourth of the total) and the costs for ictus are €38 billion (about one-fifth of the total).

Fifty-seven percent of the total economic impact of cardiovascular diseases is due to direct health costs, and 43% is due to indirect costs because of lost productivity and other non-health costs.

Health spending for cardiovascular disease totals nearly €110 billion, which equals 10% of the total health expenditure.

The total costs of cardiovascular diseases were calculated as approximately €21.8 billion in 2006.²⁰ Of this total, 63% (€13.8 billion) concerned the direct costs incurred by the health system, including the costs of hospitalization and the cost of drugs. Thirty-seven percent of the total economic impact is due, instead, to the indirect costs for the loss of productivity in the patients of working age, caused by their illness (these are the costs of morbidity, equal to €1.4 billion) and by death (equal to €2.6 billion), and the other informal costs for patients' treatment²¹ (equal to €4 billion), for a total of approximately €8 billion.

1.2.5 Dementia and neurodegenerative diseases

Dementia is a condition that affects 1 to 5% of the population over 65 years of age, with a prevalence that doubles every four years; dementia among people 80 years of age is 30%. Recent studies show that there is also an increased risk of dementia among individuals under the age of 65 – between 2 and 10% of the total cases occur in people below 65.

Dementia is generally defined as a condition of chronic and progressive decline of brain functions, leading to a decline in cognitive ability. The general definition of dementia includes various diseases. Some of these are classified as primary dementias, including Alzheimer's disease, dementia with Lewy bodies, and frontal-temporal dementia. Secondary dementias are a consequence of other illnesses, such as the dementia that results from AIDS.

THE TOTAL ECONOMIC IMPACT OF CARDIOVASCULAR DISEASE IN EUROPE IN 2006 AMOUNTED TO ABOUT 192 BILLION EUROS, EQUAL TO AN AVERAGE TOTAL COST OF 391 EUROS PER CAPITA

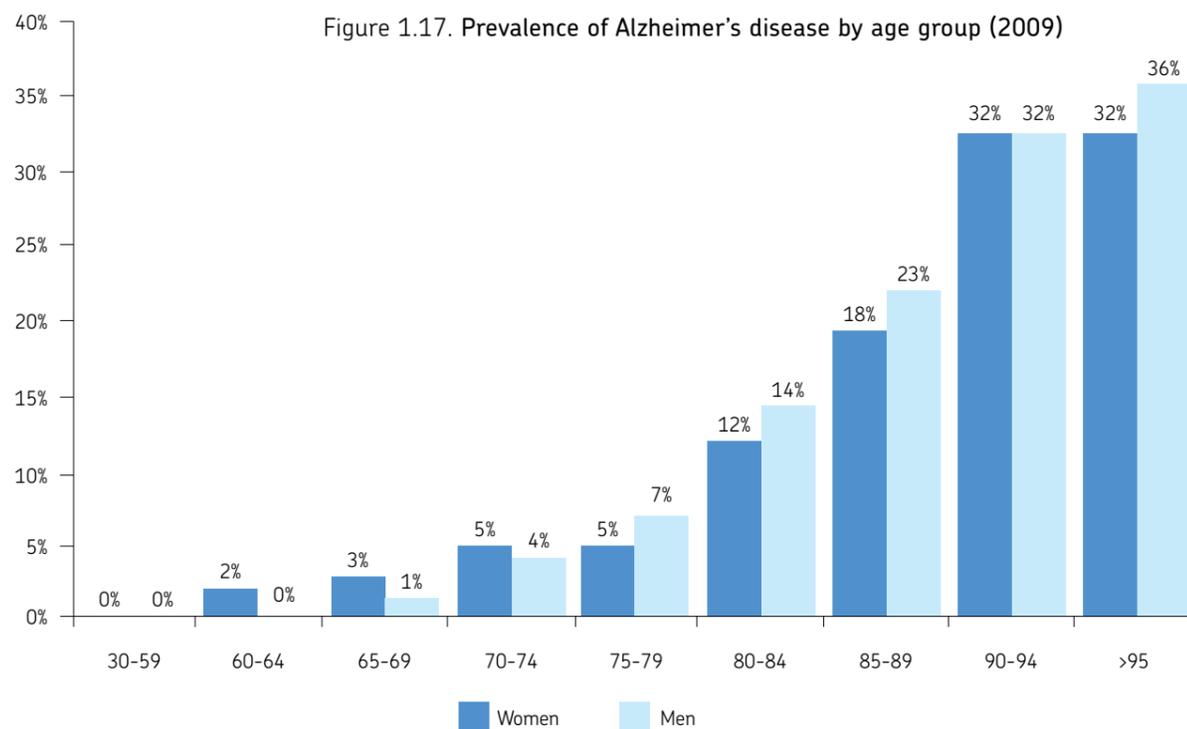
GLOBAL BURDEN OF DISEASE REPORTED THAT DEMENTIA WOULD FORCE HUMAN BEINGS TO LIVE 11.9% OF THE YEARS OF THEIR LIVES IN A STATE OF CHRONIC DISABILITY



According to the *Global Burden of Disease* study in 2010, dementia leads patients to live 11.9% of their lifetime in a state of chronic disability and to lose 1.1% years of life. The 10/66 Dementia Research Group study found that dementia is the primary cause of dependency (with the need for treatment) among the elderly in Latin America, India and China.

Economic and social impacts

The global cost in 2010 for dementia was estimated at US\$604 billion, 70% of which were costs recorded in Western Europe and North America.²² These costs are about 1% of the world GDP. In low-income countries, the costs of dementia are 0.24% of the GDP; in medium-low income countries, dementia costs 0.35% of the GDP; in medium- to high-income countries, dementia costs 0.50% of the GDP; and in the high-income countries, dementia costs are 1.24% of the GDP. In England, the social cost of dementia (£17 billion) exceeds that for ictus, heart diseases and cancer. In 2008, France promoted a program for the treatment and prevention of neurodegenerative diseases for approximately €1.6 billion. Although only 38% of the people affected with dementia live in high-income countries, they account for 72% of the costs of dementia. This is because in poorer countries, care for patients is offered informally by family members as a result of the lack of structured and accessible health services. In Italy, it is estimated that there are 2 million people living with dementia, 63% of these people are older than 80. The costs for patients and their families is very high. If the number of Italians affected by dementia is multiplied by the average annual cost per patient, the total annual cost of dementia in the country is equal to about €50 billion (€10 billion for direct costs and €40 billion for indirect costs).



Source: elaboration by The European House Ambrosetti of data from the EURODEM study.

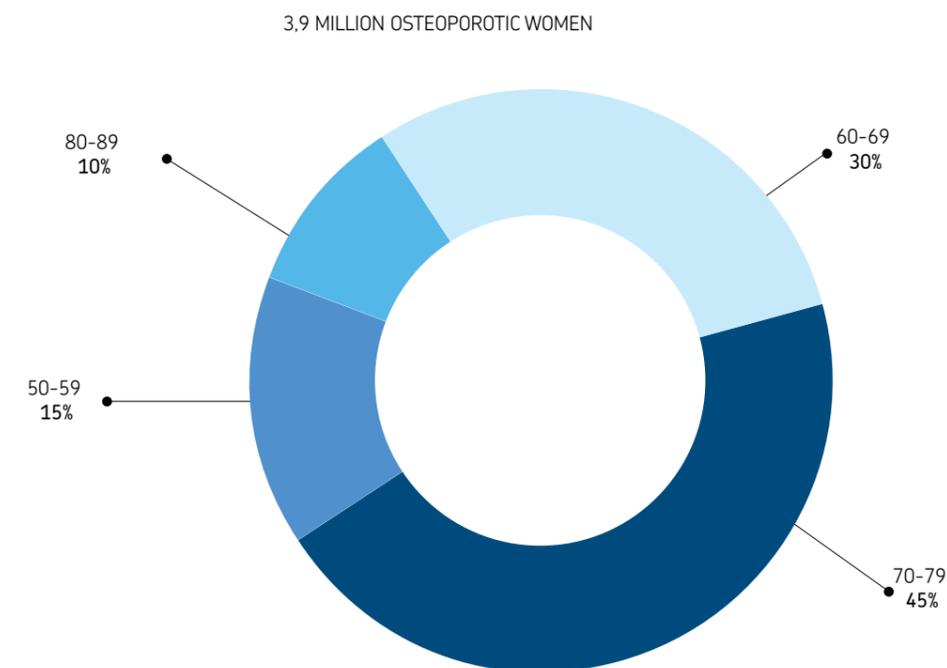
1.2.6 Osteoporosis

Osteoporosis is a disease characterized by a reduction of the bone mass and the deterioration of the micro-architecture of the bone tissue. This results in greater fragility and a consequent risk of fractures²³ that occur especially in the area of the wrist, the vertebrae and the proximal femur.

Because the number of people suffering from osteoporosis is growing, WHO has acknowledged the disease as a global health priority. Fractures as a result of osteoporosis are expected to increase from 1 every 8.1 minutes in 2001 to 1 every 3.7 minutes in 2021.²⁴ It has been estimated that 150 million people worldwide have osteoporosis. Half of those people are living in Europe, Japan and the United States and most have a 15% probability of fracturing their wrist, femur or vertebrae, which is similar to the number of people affected by coronary heart disease. In China, osteoporosis affects 70 million people aged over 50, resulting in almost 700,000 fractures a year. In Europe, one woman in three and one man in five over age 50 will experience a fracture due to osteoporosis in their lifetime. In the United States, it is estimated that 10 million people are suffering from osteoporosis, while approximately 34 million Americans are at high risk of developing this disease because of low bone mass. In Italy, osteoporosis is one of the most widespread chronic diseases associated with old age – 7% of Italians suffer from the disease. More women than men suffer from osteoporosis in Italy – it affects 3.9 million women and 840,000 men.²⁵ In the female population that is affected, 15% are women between the ages of 50 and 59, more than 30% are aged 60 to 69, and 45% are aged 70 to 79.

IT IS A GLOBAL PROBLEM THAT IS ON THE RISE: IT IS ESTIMATED THAT THE INCIDENCE OF OSTEOPOROTIC FRACTURES IS EXPECTED TO INCREASE FROM 1 EVERY 8.1 MINUTES IN 2001 TO 1 EVERY 3.7 MINUTES IN 2021

Figure 1.18. Number of osteoporotic women in Italy and breakdown by age (2006)



Source: elaboration by The European House-Ambrosetti of Esopo data.

Economic and social impacts

The economic burden of osteoporosis is comparable to that of the main chronic diseases, but in women over 45 years of age, osteoporosis is the main cause of hospitalization compared to other diseases, including diabetes, heart attack and breast cancer.

Although there is a growing awareness of how to prevent the disease, the number of fractures related to osteoporosis is likely to rise, as the age of the European population rises. The cost of treating osteoporosis in Italy, France, Germany, Sweden, the United Kingdom and Spain will rise from €31.7 billion in 2000 to €76.7 billion in 2050. This is the data that emerged from a recent study by the International Osteoporosis Foundation and represents the figure spent every year in Italy, France, Germany, Sweden, the United Kingdom and Spain on the treatment of osteoporosis fractures.²⁶

Hip fractures account for 56% of the total costs of osteoporosis, fractures of the vertebral bodies account for 5%, wrist fractures account for 2%, while combined fractures account for 37% of the total.

As mentioned above, the risk of successive fractures for people who have already suffered fractures of the femur or the vertebrae means that there is great need for new osteoporosis therapies, including those that can be effective for the entire skeletal system, not just for the femur or vertebrae, to help decrease the economic burden related to osteoporosis.

1.3 PREVENTION OF OBESITY AS A KEY FACTOR FOR HEALTH, IN ALL AGES OF LIFE

Most experts agree that a person who lives a healthy life doesn't smoke, drinks alcohol in moderation, and eats a sufficient amount of fruits and vegetables, thus reducing the possibility of incurring a chronic disease by a fourth in comparison to a person with an unhealthy lifestyle.

The mortality rate grows enormously when the individuals exceed the threshold generally acknowledged as being overweight:²⁷ in fact, the lifespan of an obese person is on the average 8-10 years shorter than that of a person of normal weight (similar data can be found concerning regular smokers). An overweight person of normal height is at a 30% higher risk of death for every 15 kg of excess weight.

In addition to physical problems, obese people also face discrimination. In the workplace, an obese person is often considered by employers to be less productive than a person of normal weight because of the greater costs for medical treatment and a greater number of days of absence from the workplace. Inevitably, obese people are often penalized by being paid less and some estimates cite a negative differential that is close to 18%.

The phenomenon of obesity, however cross-cutting it may be, appears relatively more concentrated in the female gender than in males: worldwide, in fact, the rate of obesity tends to be greater in women than in men and that can also be found in the OECD countries. Furthermore, some research has shown a disparity between the rate of obesity among the female population of rich countries and that of poor countries, while the data on the male population is rather uniform.

It is not easy to precisely estimate the impact of obesity on the mortality rate. However, a study conducted by Olshansky (2005),²⁸ published in one of the most important medical magazines in the world, estimated that the increase in obesity will lead to a revision of the estimates of life expectancy in the United States in the first half of this century. The UK Department of Health has estimated that if the growth of obesity continues at its current levels, by 2050, life expectancy will be lowered by at least three years. The estimates appear alarming, to say the least.

Is it possible to act to reverse these tendencies? The answer is yes. National governments in the OECD countries have planned and carried out many programs for improving the diet and promoting physical exercise, starting from infancy, in order to prevent obesity and mitigate its devastating effects.

In particular, the OECD and WHO have identified three major areas of interest and nine possible interventions, deemed successful; and they have also gathered data and factual evidence aimed at estimating the prospective impact of these interventions.

Their analysis shows that nutritional advice and activities that change behavior are the most effective ways to prevent chronic diseases, generating a greater impact in terms of the years of life gained on average.

THE LIFE EXPECTANCY OF AN OBESE PERSON IS ON AVERAGE 8-10 YEARS SHORTER THAN THAT OF A PERSON OF NORMAL WEIGHT



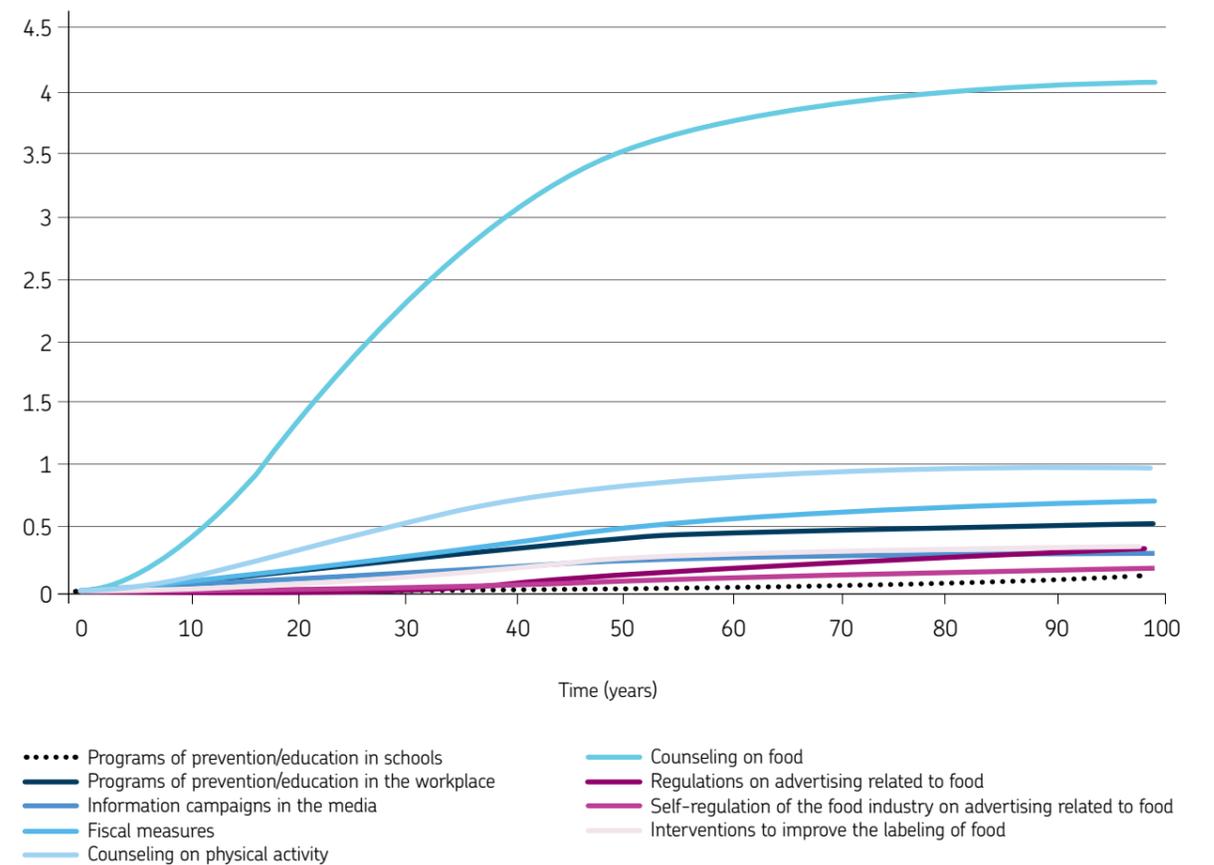
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INTERVENTIONS EDUCATION AND PROMOTION HEALTH	1. Programs of prevention/education in schools 2. Programs of prevention/education in the workplace 3. Information campaigns in the media
ACTION LEVEL OF PRIMARY CARE	4. Counseling on physical activity 5. Counseling on food
TAX MEASURES AND REGULATION OF THE AGRO-FOOD INDUSTRY	6. Fiscal measures on the prices of fruits, vegetables and food with high-fat content 7. Regulations on advertising related to food 8. Self-regulation of the food industry on advertising related to food 9. Interventions to improve the labeling of food
INTEGRATED MEASURES	10. Combined Strategy (of the nine preceding points)

To understand which kinds of diets are able to prevent the occurrence of obesity (and, thus, the onset of diseases linked to it), it is essential to be able to identify what tools are in our possession to ensure, throughout a person's entire lifetime, the attainment of longevity in good health.

Figure 1.19. Years of life gained due to prevention of mortality and morbidity



Source: elaboration by The European House Ambrosetti of CDP data (Model-based analysis relying on input data from multiple sources, listed in Table A.2 in Annex A).

2. THE ROLE OF DIET IN PREVENTING DISEASE



2. THE ROLE OF DIET IN PREVENTING DISEASE

The World Health Organization (WHO) defines health as a state of complete physical, mental and social well-being, and not only the absence of diseases or infirmities.¹ A healthy lifestyle, however, is a way of living that reduces the risk of diseases and premature death.²

Diet is one of the most important components of a healthy lifestyle – poor eating habits can be a prime factor in the onset of the major non-communicable diseases. Eating nutritious foods and maintaining physical activity throughout life are indispensable habits for both adults and children.

From the standpoint of human health, there has been a gradual change in human eating habits, or a diet transition, since the second half of the twentieth century. Over the last fifty years, there have been significant changes in medicine and healthcare, life expectancy and diet. These changes include:

- Advances in scientific and medical progress;
- Increase in the average life expectancy, for both men and women;
- The decline in the spread of communicable diseases and the increasing incidence of non-communicable diseases;
- And, perhaps most significantly, a transformation of eating habits and lifestyle, with major increases in the average intake of calories and a reduction in physical activity.

At the same time, however, diet plays an extremely important role in preventing diseases and helping individuals maintain good health throughout their lives. Good nutrition can literally be the best medicine of all.

A particularly helpful synthesis of the diet-prevention issue is the recent work by WHO in the report *Diet, Nutrition, and the Prevention of Chronic Diseases*, and their dietary recommendations, which will be summarized in the following.

2.1 MAIN EVIDENCE FROM THE INTERNATIONAL LITERATURE ON THE RELATION BETWEEN DIET, PREVENTION AND CARDIOVASCULAR DISEASES

Worldwide, cardiovascular diseases account for a very high proportion of the chronic, non-communicable diseases. Furthermore, according to WHO, there is often a “delay effect” in the manifestation of cardiovascular disease. In other words, risk factors, including poor diet, that make people more susceptible to heart problems, can occur years before a patient is eventually diagnosed. This “delay effect” implies that the present mortality rate from cardiovascular disease is a result of dietary and behavioral habits that occurred long before the symptoms of the disease.

Physical activity

One of the most important factors for preventing cardiovascular disease is to engage in regular physical activity for at least 30 minutes a day. People who get adequate physical activity have less risk of cardiovascular disease, especially coronary disease.

PRACTICING REGULAR PHYSICAL ACTIVITY FOR AT LEAST 30 MINUTES A DAY

Fatty acids and a diet with high cholesterol content

The relationship between cardiovascular disease and diets high in fat is well documented and investigated in the scientific literature. The adoption of a diet with high concentrations of fats has been extensively studied and there have been different observational, clinical and metabolic studies conducted on different human populations³ and experiments on animals. According to this evidence, saturated fatty acids increase both the total amount of cholesterol and the amount of LDL cholesterol, which is commonly known as “bad” fat. The lipoproteins in LDL transport cholesterol from the liver and deposit it on the walls of the arteries, favoring the formation of atherosclerotic plaques or blockages. Other studies have also shown that not all saturated fatty acids produce the same adverse effects to human health and the cardiovascular system.⁴

Among the factors that increase the risk of developing cardiovascular disease are the consumption of myristic acid⁵ and, to a lesser extent, palmitic acid.⁶ These acids are found in meat, cheese, milk, butter, cream and tropical oils, such as palm oil. Stearic acid, however, has not been found to raise blood cholesterol.

One of the most effective solutions for reducing the risk of coronary heart disease is to replace saturated fats with unsaturated fats (monounsaturated and polyunsaturated), such as oleic acid. Numerous studies and clinical trials have indeed shown that replacing saturated fats and trans-fats with polyunsaturated vegetable oils significantly lowers the risk of heart disease.⁷

THE 27% INCREASE IN THE RISK OF INCURRING CARDIOVASCULAR DISEASE AND ABOUT 30,000 DEATHS EACH YEAR IN THE UNITED STATES ARE ASSOCIATED WITH DIETS RICH IN TRANS-FATS

It has also been proven that there is a relationship between diets containing high amounts of trans-fatty acids,⁸ coronary heart disease and atherosclerosis because trans-fatty acids are the most harmful to the cardiovascular system and are formed during the hydrogenation process.

In summary, trans-fatty acids are generated from three main sources:

- Hydrogenation or transformation of a liquid oil into a solid fat;
- Treatments at high temperatures, such as frying;
- And bacterial activity of the digestive tract of ruminants that generates the unique natural trans-fatty acids present in milk and other dairy products.

In a study, Mensink⁹ showed that trans-fats raise the level of LDL cholesterol by lowering the HDL cholesterol ratio and worsening the risk of cardiovascular disease. Many other subsequent studies have confirmed these findings. In particular, two studies have compared trans-fats with saturated fats, coming to the conclusion that the former represent a higher risk factor for cardiovascular diseases.¹⁰ In 2002, the National Academy of Sciences (NAS)¹¹ further endorsed the view that trans-fats are worse than saturated fats for the risk of developing cardiovascular disease and they recommended their total elimination from the diet of every individual.¹²

Even epidemiological studies have confirmed the relationship between cardiovascular risk and trans-fats. Both the study by Willett,¹³ based on a well-known database of more than 85,000 women and developed as part of the Nurses Health Study which began in 1976, and another study by Ascherio,¹⁴ found that the risk of cardiovascular disease increased by 27% when people consumed foods high in trans-fats, and about 30,000 deaths annually in the United States may be associated with diets high in trans-fats. Research by Koletzko¹⁵ also came to the same conclusion, estimating between 25,000 and 30,000 deaths in the United States as a result of diets high in trans-fats. These results have also been confirmed by other studies, including Oomen¹⁶ and Willet.¹⁷

Because of the clear and obvious correlations found in the literature between the amount of trans-fatty acids and risk of cardiovascular disease, the concentration of these fatty acids in foods has been the subject of restrictive laws and regulations at the international level. These laws define the maximum concentration of trans-fatty acids for every food, and long-term plans have been developed, aimed at the total elimination of trans-fats in the food industry.¹⁸

One of the solutions appears to be the replacement of trans-fats with monounsaturated and polyunsaturated fats which can reduce the concentration of low-density lipoprotein (LDL). Oleic acid is a monounsaturated fat found in olive oil, peanut oil and canola oil. Linoleic acid is a polyunsaturated fatty acid abundant in sunflowers and soybeans. Eicosapentaenoic acid and docosahexaenoic acid,¹⁹ which are found in fish, and alpha-linolenic acid, which is found in vegetables and in plants, represent the most important polyunsaturated fatty acids for reducing the risk of developing cardiovascular disease. The beneficial effects of polyunsaturated fat also affect blood pressure, heart and endothelial functions, and vascular reactivity.²⁰

Most of the results of epidemiological studies on fatty acids (n-3) have focused on the analysis of fish consumption in different populations. In particular, fish oil has been used in studies conducted by the Italian Group for the Study of Survival of Myocardial Infarction (GISSI).²¹ The results showed that after three and a half years of giving fish oil to patients, there was a 20% reduction in mortality, a 30% reduction of deaths caused by cardiovascular disease and a 45% reduction of sudden deaths.

Similarly, studies by Hu²² and Ascherio²³ showed the existence of an inverse relationship between the consumption of alpha-linolenic acid and cardiovascular disease.

Numerous studies have also shown how cholesterol in the blood and tissues is a factor that increases the risk of the onset of cardiovascular disease. Cholesterol comes from two sources, including the diet, both of individuals and populations, and endogenous synthesis. If the diet is dominated by fat, dairy products and meat, this contributes significantly to raising the level of cholesterol in the blood.

Non-starch polysaccharides and dietary fiber

Dietary fiber, which is the edible part of the plants that is resistant to digestion, is not absorbed in the small intestine of humans. In the large intestine, however, it undergoes a complete or partial fermentation.

This category includes: cellulose, gums, polysaccharides from seaweed, pectin, hemicellulose, arabinogalactans, arabinoxylans and beta-glucans, also called “non-starch polysaccharides.” Studies conducted by Anderson²⁴ found that dietary fibers help reduce the concentration of low density lipoprotein (LDL). Other studies conducted by Truswell²⁵ and Rimm²⁶ in different countries show that a diet rich in fiber and whole grains reduces the risk of developing cardiovascular disease.

Antioxidants, folate and flavonoids

In theory, antioxidants (glutathione, vitamin C and vitamin E) may protect people against cardiovascular disease, but studies are conflicting and there are no certain results that antioxidants reduce the risk of developing cardiovascular disease. The International Task Force for Prevention of Coronary Heart Disease²⁷ conducted a study with the aim of analyzing the relationship between additional doses of vitamin E and cardiovascular diseases. However, the results showed no evidence of this relationship²⁸ and, in fact, have shown that there are no significant benefits involved in the recruitment of additional doses of vitamin E, vitamin C and beta-carotene in subjects who are at high risk of developing cardiovascular disease.²⁹

The relationship between folate and cardiovascular disease has also been widely analyzed in the scientific literature because of its effect through the homocysteine, which may represent an independent risk factor for cardiovascular disease and stroke. Folic acid is used in the methylation of homocysteine into methionine, and low concentrations of folate in the blood have been associated with high levels of homocysteine. It was demonstrated by Brouwer³⁰ that additional doses of folate reduced its levels. Although numerous studies have been conducted, the scientific community has not yet reached a sufficient level of consensus on the relationship between homocysteine and cardiovascular disease.³¹ The data from the Nurses’ Health Study³² showed that folate and vitamin B6, consumed in the normal diet, or with additional doses, confer protection against diseases affecting the coronary arteries.³³

A meta-analysis study conducted by Wald,³⁴ and published recently, concluded that a high intake of folate in the diet reduces the risk of ischemic heart disease by 16% and stroke by 24%.

Finally, flavonoids are polyphenolic compounds of secondary plant metabolites, which are mainly water-soluble and present in vegetables, tea, onions and apples. Studies by Keli³⁵ and Hertog³⁶ pointed out that there is an inverse relationship between diets rich in flavonoids and cardiovascular disease.

DIETARY FIBERS HELP REDUCE THE CONCENTRATION OF LOW DENSITY LIPOPROTEIN (LDL)

HIGH BLOOD PRESSURE IS AMONG THE FACTORS THAT INCREASE THE RISK OF DEVELOPING CARDIOVASCULAR DISEASE. THE MOST AND SODIUM INTAKE IS DIRECTLY RELATED TO BLOOD PRESSURE

Sodium and potassium

High blood pressure is one of the factors that further increase the risk of developing cardiovascular disease, ischemic disease and hemorrhagic stroke. The effect of sodium on health has been studied and analyzed through epidemiological and clinical studies and experiments on animals.³⁷

The results of most studies show that sodium intake is directly related to high blood pressure; more specifically, a difference of 100 millimoles/liter in daily sodium consumption is associated, on average, to a difference in systolic blood pressure of 5 mmHg for individuals aged between 15 and 19, and 10 mmHg for individuals aged between 60 and 69.³⁸

It has been estimated that a 50% average reduction of millimoles/liter of sodium would lead to a 50% reduction of people who are undergoing anti-hypertensive therapy, a 22% reduction of deaths from stroke, and a 16% reduction of those due to cardiovascular diseases.

More specifically, Cutler³⁹ and Midgley⁴⁰ investigated the effects of daily salt consumption with blood pressure levels. Their results show that a reduction of 70-80 millimoles/liter of sodium is associated with a reduction in systolic blood pressure of about 4.8/1.9 mmHgI in individuals with hypertension and 2.5/1.1 mmHg in normotensive people. Sacks⁴¹ has also shown that diets low in sodium do not show any significant negative effect on human health and are, therefore, sustainable, effective and safe.

For potassium, however, the meta-analysis study⁴² found that additional doses of potassium help, on average, to reduce systolic and diastolic blood pressure of 1.8/1.0 mmHg in normotensive individuals and 4.4/2.5 mmHg in hypertensive subjects.

Ascherio⁴³ and Khaw⁴⁴ also showed that there is an inverse relationship between potassium intake and the risk of stroke but they also explained that although potassium has been shown to have beneficial effects on blood pressure and cardiovascular disease, it has not been proven scientifically that additional doses of potassium reduce blood pressure over the long run.

Other types of nutrients and foods

The consumption of fruits and vegetables has always been regarded as a good way to stay healthy. Scientific evidence relating to the protective effects of fruits and vegetables on cardiovascular disease, however, only dates back a few years.

Specifically, the studies of Ness,⁴⁵ Liu,⁴⁶ Joshipura⁴⁷ and Gilman⁴⁸ found that there is a very strong relationship between the consumption of fruits and vegetables and the occurrence of cardiovascular disease and stroke. In addition, the U.S. Department of Health and Human Services (USHH) has shown that people can get better health results by combining increased daily consumption of fruits and vegetables with a reduction of fat in the diet: in fact, in its Dietary Approaches to Stop Hypertension (DASH) report, the USHH showed that following DASH has greater benefits than diets that simply focus on increased consumption of fruits and vegetables.⁴⁹

Furthermore, many studies have shown that regular consumption of fish is associated with a lower risk of developing cardiovascular disease. Marckmann⁵⁰ has made a systematic review of studies in the literature, however, showing that the benefits may derive from the type of sample and population analyzed and that consumption of fish only brings significant benefits to the individuals characterized by a high risk of developing cardiovascular disease. In this study, it was estimated that an increase of 40 to 60 grams per day of fish would result in a reduction of 50% of deaths from cardiovascular disease in individuals at high risk. Analyzing individuals who had already had a heart attack, Burr⁵¹ observed a reduction in

deaths after the second heart attack in individuals who were advised to consume fish at least twice a week. In one study carried out in 36 countries, Zhang⁵² indicated that the consumption of fish reduces the risk of mortality in general and, therefore, reduces the onset of cardiovascular disease. Epidemiological studies carried out by Kris-Etherton⁵³ and Hu⁵⁴ have shown that the frequent consumption of nuts, including almonds, peanuts and walnuts, is associated with a reduced risk of developing cardiovascular disease. Nuts are characterized by a high concentration of unsaturated fats and are low in saturated fat. Consumers should be aware, however, that because of their high energy content, the consumption of nuts should be balanced with an individual's caloric needs.

Studies carried out by Crouse⁵⁵ have shown that consumption of soybeans and soybean products has beneficial effects on the level of fats in the blood.⁵⁶ An analysis of 38 clinical case studies found that, on average, a consumption of 47 grams of soy per day in subjects who suffer from cardiovascular disease leads to a 9% reduction of the total cholesterol and a reduction of LDL cholesterol of 13%.⁵⁷ Soy is rich in isoflavones, structurally and functionally similar to estrogen, and several animal experiments have suggested that intake of isoflavones may provide protection against cardiovascular disease. Reliable data on its effectiveness in humans, however, is not yet available.

In a meta-analysis study conducted by Rimm,⁵⁸ evidence emerged suggesting that low to moderate consumption of alcohol may reduce the risk of developing cardiovascular disease and that the consumption of beer, wine and spirits can be associated with a reduced risk of coronary heart disease. However, other studies have shown that alcohol consumption is associated with an increase in other cardiovascular diseases and should be discouraged.

Figure 2.1. Summary of main evidence found in the literature on the associations between lifestyle and dietary factors and the development of cardiovascular disease

EVIDENCE	REDUCTION OF RISK	INCREASE OF RISK	NO RELATION
SIGNIFICANT	Regular physical activity	Myristic acid	Additional doses of vitamin E
	Linoleic acid	Palmitic acid	
	Potassium	Trans-fatty acids	
	Low consumption of alcohol	High sodium intake	
		Overweight	
PROBABLE		High consumption of alcohol	
	Alfa-linolenic acid	High cholesterol	Stearic acid
	Oleic acid	Unfiltered coffee	
	Dietary fiber		
	Non-starch polysaccharides		
	Cereals		
	Plants steroids		
Folate			
POSSIBLE	Flavonoids	Lauric acid	
	Soy products	Additional doses of beta-carotene	
	Calcium	Carbohydrates	
INSUFFICIENT	Magnesium	Iron	
	Vitamin C		

Source: elaboration by The European House-Ambrosetti of data by various authors.



2.2 MAIN EVIDENCE FROM THE INTERNATIONAL LITERATURE ON THE RELATION BETWEEN DIET, PREVENTION AND DIABETES

The nutritional approach is widely recognized as a key instrument for preventing the onset of diabetes, curing the disease, and preventing and/or mitigating the development and severity of complications that result from the disease. Complications include excessive blood pressure (hypertension), excessive blood glucose (hyperglycemia) and the excessive amount of blood lipids (dyslipidemia).

There are two basic forms of diabetes, type 1 diabetes (also called juvenile diabetes) and type 2 diabetes (also called adult onset diabetes), which differ greatly in origin, severity and therapy.

In general terms, the pathology of diabetes is linked to insulin deficiency diabetes (type 1 diabetes) or insulin resistance (type 2 diabetes). Insulin is characterized by a production of baseline type insulin, which is continuous and independent of food intake; postprandial-type insulin is produced after the single and specific consumption of food. Improper absorption of osmotic glucose leads to the lack of glucose within the cells and the accumulation of glucose in the blood. High blood glucose can lead to cellular tissue damage and can cause patients to experience ketoacidosis overdose.

Patients can also experience insulin resistance, a condition in which the body produces enough insulin but does not use it properly. Insulin is produced by the pancreas and its purpose is to help the body use glucose as a source of energy. After a meal, blood glucose levels rise and the pancreas releases insulin to help cells absorb and use glucose. But when patients are insulin resistant, their muscle, fat and liver cells do not respond properly to insulin and, as a result, their bodies need more and more insulin to help glucose enter the cells. The pancreas has to increase the amount of insulin it produces to keep up with demand but eventually it fails to produce enough insulin. As a result, excess glucose builds up in the bloodstream, setting the stage for diabetes. Insulin resistance is mainly related to environmental and lifestyle factors and is only partly hereditary. There have been numerous studies about the relationship between diet and treatment or prevention of diabetes that have considered the effects and consequences of ingesting the main macro- and micronutrients upon the emergence of diabetes and their impact throughout the course of the disease.

Body weight and physical activity

Numerous studies have shown that a moderate reduction in body weight is a potential way to reduce the risk of the onset of type 2 diabetes and the progression of the disease. A modest decrease in body weight appears to be able to improve insulin sensitivity and, therefore, reduce the level of insulin resistance in individuals at risk.⁵⁹⁻⁶²

A 5-7% REDUCTION OF BODY WEIGHT, ALONG WITH REGULAR PHYSICAL ACTIVITY FOR TWO AND A HALF HOURS A WEEK AND A DIET WITH A REDUCED INTAKE OF CALORIES AND FAT ARE ABLE TO REDUCE (~60%) THE RISK OF DEVELOPING TYPE 2 DIABETES

Furthermore, in numerous clinical trials, weight reduction has proven effective in slowing the progression of glucose intolerance in type 2 diabetes in individuals at risk.^{63, 64}

The containment of abdominal adiposity appears to be particularly important for the prevention of type 2 diabetes and for improving some risk factors associated with it. Several studies⁶⁵⁻⁶⁸ have found that reducing abdominal adiposity is a major factor in determining the risk of developing type 2 diabetes with respect to the overall body mass index (BMI). It is also closely related to insulin resistance, a central element in the diabetic condition, as evidenced in a study by Després.⁶⁹

Because overweight conditions and obesity, in correlation with factors related to diabetes, tend to have many adverse effects (mainly insulin resistance), it is important that prevention and treatment programs aim for changes in lifestyles and behavior. Ideally, patients should reduce body weight 5% to 7% and increase their level of physical activity. These factors, according to a recent study by Franz, are able to reduce the probability of contracting type 2 diabetes.⁷⁰

Recent and very broad analyses confirm that weight reduction reduces the risk of type 2 diabetes. The results obtained by the Finnish Diabetes Prevention Study⁷¹ and by the Diabetes Prevention Program of the National Diabetes Education Program of the National Institutes of Health in the United States⁷² – as well as the evidence gathered by, among others, Hu,⁷³ Pan⁷⁴ and Ramachandran⁷⁵ – confirm that a 5 to 7% reduction of body weight, combined with regular physical activity of two and a half hours per week and a food strategy that includes reducing the intake of fat and calories, is able to substantially reduce (~ 60%) the risk of type 2 diabetes. Studies by Manson,⁷⁶ Kriska⁷⁷ and Helmrach⁷⁸ show that physical activity, in addition to helping reduce weight, also reduces the risk of type 2 diabetes. In addition, according to McAuley,⁷⁹ increased physical activity also appears to be able to reduce insulin sensitivity and the level of glucose in the blood.

It is widely accepted that low calorie diets are able to produce significant weight loss and reduce blood sugar and blood lipid levels.⁸⁰ Numerous studies have, however, revealed that similar low-calorie diets alone are not able to produce long-lasting positive effects in the reduction of body weight and preventing the onset of diabetes: these diets, therefore, should be considered within structured and long-term programs to maintain optimal weight.⁸¹ Dietary guidelines should go hand-in-hand with regular physical activity and, in some cases, even the use of particular strategies for maintaining weight (such as the “exchange diet”⁸²). It is also important to note that a reduction in body weight in overweight individuals also has beneficial effects for reducing the occurrence and/or the severity of the development of diseases related with diabetes, including arterial hypertension, hyperglycemia and dyslipidemia, as cited by Van Gaal,⁸³ Lean,⁸⁴ the Scottish Intercollegiate Guidelines Network (SIGN)⁸⁵ and WHO.⁸⁶

Macronutrients

There are some very important macronutrients that can help prevent diabetes.

Carbohydrates

The postprandial concentration of blood glucose appears to be, as mentioned, a central element not only for people with diabetes but also for people at risk of diabetes. As a result, both the quantity and the quality of carbohydrates consumed are of crucial importance.

The impact that carbohydrates have on the level of glucose in the blood are manifold: the specific type of food ingested, the type of starch (amylose or amylopectin) and sugars (glucose, fructose, sucrose, lactose) ingested, and the degree of food processing and

preparation methods can all influence how carbohydrates impact blood sugar levels. However, numerous studies have also emphasized the importance of the total amount of carbohydrates ingested, rather than the type or source. The evidence for these studies is derived from an analysis conducted directly on diabetic patients and their glycemic response was found to be altered: by analyzing their glycemic response after ingestion of different types of carbohydrates (in particular, starches and sugars), researchers found no significant difference for the same total quantity of carbohydrate consumed.⁸⁷

The glycemic index has been developed⁸⁸ to measure the postprandial effect of ingesting a constant amount of different types of carbohydrate foods. The index measures increases in the level of blood glucose two hours after the ingestion of a constant amount of a certain food (normally a portion equivalent to 50 grams of carbohydrates), compared to the effect generated by a “reference” food (usually glucose or white bread).

It is difficult, however, to determine the impact foods have on the glycemic response. Many factors complicate the ability to make comparisons of the effect produced by the glycemic response for similar portions of different foods, using only the glycemic index. The partial solution to this problem has been identified in the identification of an indicator called the glycemic load. The glycemic load calculates the amount of carbohydrates in a food and the glycemic index of that food, helping ensure greater comparability between similar quantities of different foods.⁸⁹

Some studies have shown that diets characterized by a low glycemic index are able to reduce the risk of type 2 diabetes and, in subjects who are already diabetic, their level of blood glucose.⁹⁰⁻⁹³ A recent study by Jenkins⁹⁴ showed that a diet characterized by a low glycemic index in diabetic patients is able to significantly reduce the level of glycated hemoglobin (HbA1c). However, there are numerous studies in the field that do not confirm the existence of such an effect. As a result, it is not possible to establish the existence of an unambiguous, scientifically-proven relationship between diets with a low glycemic index and the risk/course of diabetes.^{95, 96} In general, according to the European Association for the Study of Diabetes (EASD), the glycemic index is a useful tool for a first classification of foods, but it only has real value if used in the comparison of foods that are comparable to one another because they have similar characteristics, including their energy content and macronutrient levels.^{97, 98}

Regarding the relationship between the total amount of carbohydrates in the diet and risk factors for diabetes, there is, as has already been mentioned, sufficient scientific evidence of the possible long-term benefits arising from the adoption of diets with a very limited carbohydrate content. In fact, these diets have not proven to be particularly effective with regard to maintaining weight loss over the long term.⁹⁹

A broad meta-analysis conducted on patients already suffering from type 2 diabetes compared diets high in carbohydrates with diets high in monounsaturated fats and low in carbohydrates to identify the potential for reducing weight and the impact lipid and glucose levels. This study found that the two dietary profiles showed no significant differences on glycemic control because it was not possible to identify any significant decrease in glycated hemoglobin.¹⁰⁰

Many studies have emphasized the positive effect that consumption of fiber has on health. Typically, foods rich in fiber are also rich in vitamins, minerals and other essential nutrients. Fiber can be found in many foods, especially legumes, some varieties of cereals (especially whole grains) and some fruits and vegetables.¹⁰¹

Some studies have demonstrated the protective potential that consuming fiber has on preventing type 2 diabetes, regardless of age, body mass index (BMI) and physical activity in the people analyzed.^{102, 103}

SUFFICIENT SCIENTIFIC EVIDENCE HAS NOT BEEN FOUND CONCERNING THE POSSIBLE BENEFITS DERIVING FROM THE ADOPTION A DIET THAT IS VERY LOW IN CARBOHYDRATES



Several studies have found that high fiber intake is associated with reduced levels of glucose and insulin in the blood in individuals with impaired glucose tolerance and type 2 diabetic patients.¹⁰⁴

In addition, some studies have shown that diets with increased intakes of whole grains, fruits and vegetables (foods rich in fiber) are able to reduce the risk of developing type 2 diabetes among people with impaired glucose tolerance.^{105, 106}

The consumption of foods high in fiber can also help reduce the body mass index (BMI), both in diabetics and in healthy people.^{107, 108} Fiber can also increase the level of insulin sensitivity in non-diabetic subjects.¹⁰⁹

There is, however, still an open question concerning the link between some types of fiber and diabetes prevention. Many studies, in fact, show that soluble fiber provides the main source of benefits for preventing diabetes,¹¹⁰⁻¹¹³ while another analysis shows the positive effect fiber has on diabetes is mainly due to insoluble forms of fiber derived from cereals.¹¹⁴

Based on studies carried out in the 1980s, it is clear that diets high in carbohydrates and fiber (more than 50 grams a day and at least 50% soluble) have a positive effect on glycemic control compared with diets low in carbohydrates and fiber.¹¹⁵ At the same time, other studies emphasized the existence of a negative effect on the blood glucose level of diets high in carbohydrates and low fiber content, when compared with diets low in carbohydrates.^{116, 117, 118}

Another essential macronutrient found in carbohydrates is sugar. Numerous clinical studies have compared similar amounts of starch and sucrose in the diet and found that sucrose does not produce an increase in the blood sugar level compared to starch. Therefore, it is impossible to find a negative relationship between direct consumption of sucrose and the likelihood of incurring diabetes. However, it should be clear that there is an indirect relationship between overweight and obesity and diabetes, conditions that may be facilitated by overconsumption of sucrose.

Diets high in sugars and diets high in starch or non-starch polysaccharides can cause hypertriglyceridemia in individuals not suffering from diabetes and those with metabolic syndrome.¹¹⁹

In subjects with metabolic syndrome, researchers found that a diet rich in starch and partially rich in fibers can reduce body weight, compared to diets with a high content of sugar.¹²⁰

Some studies have shown that diets containing sugar-sweetened beverages, compared to diets containing beverages with artificial sweeteners, cause an increase in energy intake, body weight, body fat mass and the level of lipids present in the blood. This suggests that there is a correlation between the consumption of sugary beverages and the main risk factors for the development of diabetes and other major diseases, including cardiovascular disease.¹²¹

For fructose, studies have shown that eating fructose-rich foods in place of sucrose or starch in the diet helps contain the postprandial glycemic. The benefit on glucose, however, appears to be offset by a negative effect on optimal lipid levels in the blood.^{122, 123}

In any case, there is little scientific evidence that points to a negative relationship between fructose and the prevention and/or treatment of diabetes: intake of fructose in the amounts normally found in fruits and vegetables does not appear to have a negative impact on those at risk of or suffering from diabetes.

To sum up, most scientific reports agree that the presence of carbohydrates (especially whole grains and fiber) in the diet is absolutely essential.

Fats

In general, it is accepted that the quantity and quality of the fatty acids consumed has a significant influence on many risk factors for diabetes (and those diseases related to it, mainly cardiovascular disease).

MANY STUDIES HAVE SHOWN THE PROTECTIVE POTENTIAL OF THE INTAKE OF DIETARY FIBER WITH REGARD TO TYPE 2 DIABETES

OBSERVATIONAL STUDIES HAVE SHOWN THE CORRELATION BETWEEN THE CONSUMPTION OF HIGH LEVELS OF FAT AND THE PROBABILITY OF DEVELOPING IMPAIRED GLUCOSE TOLERANCE UP TO EFFECTIVE TYPE 2 DIABETES

Many studies have highlighted, in particular, that a high total daily intake of calories attributable to fat (approximately 30 to 35%) puts an individual at greater risk of weight gain and increased insulin sensitivity, and significantly increases blood LDL cholesterol values.^{124, 125}

Many studies have also highlighted the existence of a significant correlation between high levels of fat and the probability of the development of glucose intolerance, as well as the transition from intolerance to type 2 diabetes.^{126, 127}

In addition, research has found that a higher intake of saturated fatty acids is associated with a higher risk of glucose intolerance and increased levels of insulin and fasting glucose.¹²⁸⁻¹³¹

Recent studies that have examined both diabetic and non-diabetic individuals show that replacing saturated fatty acids with unsaturated fatty acids reduces insulin sensitivity and postprandial lipid levels.¹³²⁻¹³⁶ This modification can also improve glucose tolerance.^{137, 138}

Folsom,¹³⁹ Vessby¹⁴⁰ and Vessby¹⁴¹ showed that a higher intake of saturated fatty acids is related to a higher risk of type 2 diabetes; Salmeron¹⁴² and Meyer¹⁴³ showed that reducing the risk of type 2 diabetes can be correlated with an increase, above all, in consumption of unsaturated fatty acids of vegetable origin.

A change in the intake of dietary fat, or replacing saturated fats with monounsaturated ones, seems to have a particularly positive influence on the various risk factors associated with diabetes. In fact, this replacement appears to have a positive impact on the level and composition of plasma lipids and insulin sensitivity, both for individuals who have impaired glucose tolerance and for healthy individuals.¹⁴⁴⁻¹⁴⁸

Some metabolic studies have shown that by maintaining the body weight of individuals analyzed and keeping the amount of total calories consumed by them constant, diets with a low presence of saturated fatty acids and a high presence of carbohydrates or monounsaturated fatty acids of cis type are able to reduce the level of LDL cholesterol in the blood,¹⁴⁹⁻¹⁵³ even in diabetic patients.¹⁵⁴

Studies comparing the adoption of diets with high levels of carbohydrates (~55% of total calories) to diets with high levels of monounsaturated fatty acids have shown that high carbohydrate diets lead to a relatively greater level of postprandial glucose, insulin and triglycerides in the blood. The replacement of a part of the carbohydrates in the diet with monounsaturated fatty acids seems to have a positive effect on the plasma concentrations of lipids¹⁵⁵ and on blood pressure levels.¹⁵⁶ The same is true when comparing a diet high in monounsaturated fats to a diet with a high content of polyunsaturated fats.¹⁵⁷

However, other studies have confirmed the negative effect of diets rich in carbohydrates (compared to those rich in monounsaturated fats), and diets rich in monounsaturated fatty acids do not significantly improve the level of glycated hemoglobin compared to diets rich in carbohydrates.¹⁵⁸⁻¹⁶²

Furthermore, the substitution of carbohydrates with fats could facilitate an increase in body weight because of the possible increase in the total energy food intake, while a diet low in fat and high in fiber and consumption of foods containing carbohydrates with a low glycemic index seems to help weight reduction and metabolic control in both diabetic patients and in those with metabolic syndrome.^{163, 164}

Some studies have found that substituting saturated fatty acids with polyunsaturated fatty acids^{165, 166, 167} can have positive effects on the concentration and composition of lipids in the blood. This substitution also has beneficial effects in terms of insulin sensitivity¹⁶⁸ and the probability of occurrence of fatal cardiovascular events in the diabetic population.^{169, 170}

In relation to the intake of linoleic acid, it is important to keep in mind that, although there is no specific evidence in this regard, the acid should not be consumed in excessive amounts (no more than 10% of total daily calories), for reasons of prudence and because of the possibility of an increased risk of lipid peroxidation processes.¹⁷¹

THE ADOPTION OF A DIET LOW IN FAT AND HIGH IN FIBER CONTAINING CARBOHYDRATES WITH A LOW GLYCEMIC INDEX SEEMS ABLE TO HELP IN THE REDUCTION OF WEIGHT AND IN THE METABOLIC CONTROL IN DIABETES PATIENTS AS WELL AS IN THOSE WITH METABOLIC SYNDROME

Instead, there do not seem to be any significant differences between diets high in monounsaturated fatty acids and diets high in polyunsaturated fatty acids,¹⁷² but a prospective study by Trichopoulou¹⁷³ showed how a diet in which the polyunsaturated fatty acids are replaced with monounsaturated fatty acids is able to reduce the mortality rate by 7% in the elderly European population. Some studies, in fact, show that diets rich in polyunsaturated fats were found to have the same effect on the lipid concentration in the blood as diets high in monounsaturated fats.¹⁷⁴⁻¹⁷⁷

Regarding type n-3 of long chain polyunsaturated fatty acids (alfa-linolenic), some studies have identified a positive relationship between an increase in their consumption (e.g., through fish oil) and the improvement of insulin sensitivity.¹⁷⁸ The increased consumption of these fatty acids, as already mentioned, is related to a reduced risk of death from heart disease and stroke.^{179, 180}

The consumption of a greater amount of polyunsaturated fatty acids of the n-3 type can not only lead to an increase in LDL cholesterol, but to a more than proportional increase of HDL cholesterol as well, with a consequent annulment of the potential negative effects.^{181, 182}

Some studies have shown, moreover, that the intake of n-3 long chain fatty acids can lead to an increase in blood glucose, despite the fact that recent meta-analysis studies have demonstrated that this effect is not, in fact, significant.^{183, 184}

Although much evidence clearly shows the positive impact of consuming n-3 and n-6 fatty acids, there is no precise definition of the best ratio of n-3/n-6 fatty acids.

Numerous studies have indicated that a diet characterized by a high content of trans-fatty acids increases the risk of type 2 diabetes¹⁸⁵ and adversely affects the postprandial insulin levels in individuals who already suffer from type 2 diabetes.¹⁸⁶

With regard to dietary cholesterol, many studies, conducted both on patients with diabetes and on healthy subjects, have revealed a significant increase in plasma cholesterol by increasing the amount of dietary cholesterol that is consumed.^{187, 188, 189}

Proteins

Currently, there is not sufficient scientific evidence supporting the long-lasting benefits of high protein diets (15-20% of total caloric intake) for either preventing or reversing diabetes. In most Western countries, the consumption of protein is 10-20% of total daily calorie intake, equivalent to a consumption of about 0.8 to 2.0 g/kg body weight per day. Numerous studies have shown that both in healthy individuals and in patients with type 2 diabetes, the glucose produced by the metabolism of protein does not generate an increase in the concentration of glucose in the blood, but it does have an effect on insulin response, causing an increase.^{190, 191}

Some studies have identified a negative relationship between blood concentrations of glucose and insulin levels and diets with a protein content greater than 20% of total calorie intake.¹⁹² In addition to limiting these concentrations, these diets are also able to reduce appetite and increase the sense of satiety, helping facilitate the control of body weight.

Despite these scientific results, the American Diabetes Association (ADA), in its recent *Nutrition Recommendations and Interventions for Diabetes* in January 2008, noted that, on the whole, high protein diets have not been sufficiently analyzed for their long-term effect on the regulation of calorie intake and body weight or the ability of individuals to actually follow these diets for prolonged periods of time.

Regarding the reduction of protein in the diet, it is useful to remember that people with diabetes (or at a high risk of diabetes) often have an increased protein turnover

CURRENTLY, THERE DOES NOT SEEM TO BE SUFFICIENT SCIENTIFIC EVIDENCE SUPPORTING THE EXISTENCE OF LONG-LASTING BENEFITS IN TERMS OF PREVENTION AND CURE OF DIABETES, DERIVING FROM THE ADOPTION OF A DIET CHARACTERIZED BY A GREATER CONSUMPTION OF PROTEIN THAN WHAT IS CONSIDERED TO BE APPROPRIATE FOR OBTAINING A CORRECT AMOUNT OF PROTEIN (15-20% OF THE TOTAL CALORIC INTAKE)

(essentially identifiable in the ratio of proteins used, or eliminated in the case of diabetic nephropathy, and proteins ingested). For these individuals, there does not seem to be a very positive overall reduction in protein intake: however, its reduction could give rise to beneficial effects, but the intake of protein should not be less than 0.6 g/kg of ideal body weight/day because the intake of a more limited quantity can cause potential malnourishment.¹⁹³⁻¹⁹⁶

Micronutrients

At the present time, as shown by Guerrero-Romero¹⁹⁷ and Kligler,¹⁹⁸ there does not appear to be sufficient evidence from long-term clinical trials identifying the safety and potentially positive role of chromium, magnesium and antioxidants in the preventive and therapeutic approach to type 2 diabetes. The results obtained from the various studies are, to a certain extent, contradictory, or in some cases, not sufficiently significant. Also WHO, in its recent report *Diet, Nutrition and the Prevention of Chronic Diseases*, confirms the absence of adequate evidence to support the hypothesis that chromium and magnesium can provide a form of protection to the risk of type 2 diabetes.

With regard to antioxidants, numerous clinical trials have highlighted both the lack of obvious benefits in relation to glycemic control and a potential health risk as a whole, regarding the introduction of doses of vitamin E, vitamin C, carotene and other antioxidant supplements that would release the levels naturally present in a balanced and varied diet.^{199, 200, 201} Moreover, the available data does not show that supplementing the diet with these micronutrients reduces the risk of developing cardiovascular diseases²⁰² and numerous studies have not found any direct benefit attributable to the integration of chromium in the diet of individuals with type 2 diabetes or glucose intolerance, as a way to either manage blood glucose levels or maintain a healthy body weight.^{203, 204, 205}

Alcohol

Some studies have shown that a moderate consumption of alcohol during meals does not generate a significant acute effect on blood glucose level and insulin concentration.²⁰⁶

A high consumption of alcohol has been linked, independently of body mass index, with a higher waist-hip ratio²⁰⁷ and carbohydrates ingested with alcohol seem to be able to increase glucose plasma. According to several studies, alcohol may also increase triglyceride levels and the risk of hypoglycemia.^{208, 209}

Despite these results, a moderate consumption of alcohol seems to have a potential positive effect on insulin-sensitivity^{210, 211, 212} and appears to correspond to a reduction of coronary heart disease risk^{213, 214} and of stroke.²¹⁵ Moderate alcohol consumption has also been found to increase levels of HDL cholesterol in the blood and reduce indices of coagulation and lipid oxidation (this happens through the action of antioxidants present in some alcoholic beverages).

Some studies have shown, in particular, that a moderate intake of alcohol, if practiced on a regular basis, has a positive effect superior to less frequent, but quantitatively more significant consumption; these same studies have not, however, identified a significant link between the time of consumption in relation to meals or the type of alcoholic beverage consumed and the positive effects of alcohol.^{216, 217}

According to WHO, there is little evidence that links moderate consumption of alcohol and the prevention of type 2 diabetes.

Figure 2.2. Summary of main evidence found in the literature and associations between lifestyle, dietary factors and the development of diabetes

EVIDENCE	REDUCTION OF RISK	INCREASE IN RISK
SIGNIFICANT	Reduction of body weight in overweight and obese people	Overweight conditions and obesity
	Physical activity	Abdominal obesity Absence of physical activity
PROBABLE	Dietary fibers	Saturated fats
POSSIBLE	n-3 polyunsaturated fatty acids	Total quantity of fat intake
	Foods low in glucose	Unsaturated trans-fatty acid
INSUFFICIENT	Vitamin E	
	Chromium	
	Magnesium	
	Moderate alcohol consumption	

Source: elaboration by The European House-Ambrosetti of data by various authors.



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2.3 MAIN EVIDENCE FROM THE INTERNATIONAL LITERATURE ON THE RELATION BETWEEN DIET, PREVENTION AND CANCER

THE INTERNATIONAL AGENCY FOR RESEARCH ON CANCER (IARC) HAS INDICATED THAT BEING OVERWEIGHT AND THE LACK OF PHYSICAL ACTIVITY ACCOUNT FOR AN INCREASED RISK OF BREAST, COLON AND KIDNEY CANCER, AS WELL AS CANCER OF THE ESOPHAGUS

Cancer can be caused by multiple factors, some of which are known, while others are still unknown to the international medical research community. Tobacco smoke, eating an unhealthy diet, physical inactivity, infections, hormonal factors and radiation are all factors that trigger cancer. According to some studies, the adoption of an unhealthy diet increases the risk of cancer by 30% in industrialized countries, second only to tobacco smoke.²¹⁸ This risk of cancer in developing countries from eating an unhealthy diet is 20%,²¹⁹ but may increase substantially in the face of likely future dietary changes which are already taking place in industrialized countries. The rate of cancer detected in a population and its percentage rate varies because the type of diet and lifestyle habits of the different countries analyzed also vary. The International Agency for Research on Cancer (IARC)²²⁰ found that overweight conditions and physical inactivity are factors that lead to between 20% and 35% of the cases of breast, colon and kidney cancer and cancer of the esophagus.

Obesity and overweight conditions

Obesity and overweight are factors that increase the risk of developing various types of cancer. In particular, the IARC²²¹ found that overweight conditions and obesity increase the risk of cancer of the colon and rectum. A subsequent study by Calle²²² confirmed the association between obesity and colorectal cancer, and the rate is higher in men than women. In addition, studies by Cummings and Bingham²²³ found that diet type explains over 80% of the differences in colorectal cancer rates in the various countries surveyed. In other words, the onset of this type of cancer substantially depends on the type of diet that is consumed. Worldwide, the rates of colorectal cancer are ten times higher in developed countries than in developing countries. In the United States alone, where the percentage of overweight and obese people is very high, colorectal cancer is the second leading cause of death from cancer.²²⁴ In an analysis of the risk factors for cancers of the oral cavity, Brown²²⁵ noted that being overweight or obese increased the risk of developing adenocarcinoma²²⁶ of the esophagus. A study conducted by Michaud²²⁷ found that overweight conditions and obesity are risk factors for pancreatic cancer, especially when combined with a high consumption of meat and a low consumption of vegetables in the diet. Regarding breast cancer, numerous studies, including those by Radimer,²²⁸ Trentham-Dietz,²²⁹ Carmichael²³⁰ and Stephenson,²³¹ have shown that overweight conditions, especially in adulthood, increase the risk of developing breast cancer. Overweight conditions and obesity can also increase the risk of endometrial cancer, as revealed in studies by Amant.²³² A study by Bergstrom²³³ argues that this risk is about three times

higher in obese women than in women of normal weight. Also in the studies by Bergstrom,²³⁴ overweight conditions and obesity are the trigger in 30% of the cases of kidney cancer. Although the etiology of kidney cancer is still poorly understood, the IARC²³⁵ highlighted in 2002 that there is sufficient evidence to show that excessive body weight is a risk factor for the onset of kidney cancer.

Alcoholic beverages

In developed countries, the main dietary risk factor for cancer of the mouth, larynx and esophagus is the consumption of alcoholic beverages. If the consumption of alcohol is added to the use of tobacco, this can explain more than 75% of all the cases of cancer of the oral cavity.²³⁶ The results of the studies by McKillop²³⁷ showed that excessive consumption of alcohol represents a risk factor for the occurrence of liver cancer, probably through the development of liver cirrhosis. Smith-Warner²³⁸ has also shown that an increase in the daily consumption of alcohol increases the risk of breast cancer. Other studies by Hamajima²³⁹ and Feigelson²⁴⁰ produced the same results. In general, although the latter association is not well known, studies by Dorgan²⁴¹ indicate that a relationship between alcohol and breast cancer may exist and that this may be due to the increase in the levels of some types of estrogen. Finally, in some specific studies on alcohol, Giovannucci²⁴² found that alcohol consumption is associated with a higher risk of developing colorectal cancer.

Fruits and vegetables (dietary fibers)

The IARC²⁴³ has shown that about 60% of cancer of the oral cavity is probably related to micronutrient deficiencies as a result of diets that lack fruits and vegetables. Potter²⁴⁴ found a weak association between the consumption of fruits and vegetables and colorectal cancer. In addition, a meta-analysis study conducted by Jacobs²⁴⁵ found a weak association between dietary fiber intake and reduced risk of colorectal tumors. More recent studies by Mikels²⁴⁶ and Bueno de Mesquita²⁴⁷ have shown conflicting results. One study suggested an inverse relationship between the consumption of fruits and vegetables and colorectal cancers; while another study found that there is a clear and definite relationship between the consumption of fruits and vegetables and colorectal cancer. Also, in studies by Schatzkin²⁴⁸ and Alberts,²⁴⁹ which are based on a sample of individuals who were administered additional doses of dietary fiber, fruits and vegetables, and who reduced intake of fats in their diets three and four years, a relationship between these foods and nutrients and the recurrence of colorectal cancer was not found. Although there is a no clear and precise relationship between fruit and vegetable consumption and incidence of colorectal cancer, the results of several scientific medical studies indicate that consumption of those foods may reduce the occurrence of colorectal cancer. In analyzing the risk factors for stomach cancer, Gonzalez²⁵⁰ noticed that the consumption of fruits and vegetables is a protective factor against cancer of the stomach; and in a recent study, Bandera²⁵¹ suggested that a diet consisting of high amounts of fruits and vegetables reduces the risk of endometrial cancer. Many studies have shown that fruits and vegetables also have a protective role against lung cancer.²⁵² It should be noted, however, that the apparent protective role of fruits and vegetables against lung cancer is not proven because those who smoke (which is the first risk factor for lung cancer) consume, on average, less fruits and vegetables than non-smokers. Lastly, Key²⁵³ and Smith-Warner²⁵⁴ found no specific associations with fruits, vegetables and dietary fiber and the determinants of breast cancer.

ALTHOUGH THE RELATIONSHIP HAS NOT BEEN CLEARLY AND PRECISELY DEFINED, STUDY RESULTS INDICATE THAT THE CONSUMPTION OF FRUITS AND VEGETABLES MAY REDUCE THE OCCURRENCE OF COLORECTAL CANCER

Meat, cold cuts and sausages

The international medical community agrees that many aspects of the Western diet, including the consumption of meat, cold cuts, sausages and other processed meats, increases the risk of cancer. A meta-analysis study conducted by Norat²⁵⁵ found that high consumption of preserved meat and a diet high in fat increase the risk of developing colorectal cancer. Other studies have found, however, that the consumption of poultry (white meat) and fish reduces the risk colon-rectum cancer.²⁵⁶

Shuurman,²⁵⁷ Chan²⁵⁸ and Michaud²⁵⁹ observed that the high consumption of red meat and animal products is correlated with the development of prostate cancer, which was also confirmed in studies by Kolonel²⁶⁰ and Rodriguez.²⁶¹

Finally, a study by Michaud²⁶² shows that a high meat diet represents a risk factor for cancer of the pancreas.

Folate, vitamins, beta-carotene, selenium, calcium and lycopene

Analysis by Giovannucci²⁶³ about the determinant factors of colorectal cancer found that high intakes of folate and vitamins reduce the risk of colorectal cancer. In Giovannucci's other, more specific studies about vitamin D, he noted that ingesting vitamin D can prevent the onset of cancer of the colon and rectum.²⁶⁴

In general, medical and scientific studies about the causes and factors leading to the onset of lung cancer have produced controversial results that are often in disagreement. Numerous observational studies have shown that individuals who become ill with lung cancer follow, in general, a diet with a low intake of beta-carotene,²⁶⁵ whereas Hennekens,²⁶⁶ Omenn²⁶⁷ and international study groups²⁶⁸ tested the link between the latter and the occurrence of lung cancer, without finding the existence of specific associations.

Studies conducted by Heinonen²⁶⁹ and Clark²⁷⁰ have shown that additional doses of beta-carotene have no effect on the level of risk of prostate cancer, but additional doses of vitamin E and selenium may have protective effects.

Bonithon-Kopp²⁷¹ and Baron²⁷² have indicated that a high intake of calcium in the diet has protective functions against the tumors of colon-rectum cancer, and that calcium can also act as a factor in preventing the recurrence of tumors in the same individual.

Giovannucci²⁷³ noted, however, that additional doses or high intakes of calcium in the diet increase the risk of developing aggressive prostate tumors. Kristal²⁷⁴ has shown that lycopene, a substance found in tomatoes, is a protective factor against prostate cancer.

Salt and foods preserved with salt

Some studies conducted internationally and in Asia by Ferlay²⁷⁵ and Yu²⁷⁶ have observed that nasopharynx cancer is particularly common in Eastern Asia and has been associated with high consumption of salted fish (as a part of Chinese tradition), especially during childhood.²⁷⁷

Palli²⁷⁸ and Kelley²⁷⁹ have observed that the increased risk of stomach cancer is associated with high intake of foods preserved with salt, as well as cold cuts and pickles.

Hot foods and beverages

Sharp,²⁸⁰ analyzing the causes of esophageal cancer, found that there is a significant correlation between the consumption of hot foods and drinks and increased risk of cancers of the oral cavity.

Regular physical activity

The number of cancers detected in a population and the percentage rates vary for the different countries analyzed, just as the type of diet varies in these countries. More importantly, the habits of individuals vary.

The IARC²⁸¹ has shown that physical inactivity, combined with excess weight, is a factor that causes between 20% and 35% of the cases of onset of breast cancer, colon cancer, kidney cancer and esophageal cancer.

Specific studies by Martinez²⁸² and Hardman²⁸³ have indicated that regular physical activity is associated with a significant reduction in colorectal cancer.

Figure 2.3. Summary of main evidence found in the literature and associations between lifestyle, dietary factors and the development of cancer

EVIDENCE	REDUCTION OF RISK	INCREASE IN RISK
SIGNIFICANT	Regular physical activity	Overweight conditions and obesity (oral cavity colon-rectum, breast, endometrial, kidney and pancreas cancer)
	Lycopene (prostate cancer)	Alcohol (oral cavity, liver, breast and colon-rectum cancer)
		Salt-preserved fish typically Chinese (nasopharynx)
PROBABLE	Fruits and vegetables (oral cavity, stomach and colon-rectum cancer)	Preserved meats (colon-rectum, pancreas and prostate cancer)
	Calcium (colon-rectum cancer)	Calcium (prostate cancer)
		Food preserved with salt (stomach cancer)
		Salt (stomach cancer)
		Very hot beverages and food (oral cavity cancer)
		Saturated fatty acids (breast cancer)
POSSIBLE/INSUFFICIENT	Dietary fibers	Animal fatty acids
	Soy	
	Omega 3 fatty acids	
	Vitamin B2, B6, B12, C, D, E	
	Zinc and selenium	
	Beta-carotene (lung cancer)	
	Ingredients in non-nutrient plants (flavonoids, isoflavones and lignans)	

Source: elaboratione by The European House-Ambrosetti of data by various authors.

2.4 MAIN EVIDENCE FROM THE INTERNATIONAL LITERATURE ON THE RELATION BETWEEN DIET, PREVENTION AND NEURODEGENERATIVE DISEASES

The increase in average life expectancy that is characteristic of Western society has led to the emergence of major public health issues because of the social burden of chronic diseases and disabling conditions that result from aging. Among these, chronic cerebral involution is probably the most painful for the patient and his family, as well as the most costly to society.

Dementias, such as neurodegenerative diseases, are primary disorders that tend to onset or worsen with age. Regardless of the pathological picture, it has been ascertained that the damage is the result of an interaction between genetic predisposition and environmental factors, which may include lifestyle, nutrition, infectious agents and environmental toxins.

With regard to the diet, in particular, the relationship between nutrient deficiency and dementias has been highlighted for some time. A study conducted in the late 1980s looked at the various endogenous and exogenous protective factors in the serum of patients with Alzheimer's or vascular dementia and it revealed significant decreases in levels of vitamin E, C, carotenoids, zinc and albumin.²⁸⁴ Whether this reflects an incorrect diet or is a direct influence of the disease on biochemical data remains to be seen and studied.

Some experiments have shown particular aspects of the oxidative reactions in the brain of patients with Alzheimer's.²⁸⁵ Some antioxidants, such as vitamin E, which is found in seeds, in some cereals, fruits and raw vegetable oils, appear to have potential beneficial effects in the case of Alzheimer's because they appear to protect neuron cultures against beta-amyloid toxicity²⁸⁶ and reduce oxidative stress produced by other important factors of the disease.

For Parkinson's disease, researchers found²⁸⁷ that vitamin E, beta-carotene, vitamin C and flavonoids – natural chemical compounds widely found in many fruits (citrus fruit, apples, apricots, etc.), vegetables (cabbage, broccoli, spinach, tomatoes, fennel, onions, etc.), and in some drinks (red wine, tea and fruit juices) – could protect against the onset of the disease in a small sample of participants.²⁸⁸

Although some studies have criticized the involvement of metals in the evolution of several neurodegenerative diseases,²⁸⁹ there is nevertheless much evidence showing that ionic imbalances may be partially responsible for neuronal damage.

In fact, there is evidence that dementia is associated with a deficiency of magnesium (contained in many foods such as cereals, nuts, almonds, peanuts, buckwheat, cocoa, wheat germ, lentils, green vegetables, meat and starchy foods), which is known for its protective action in the brain.²⁹⁰ This could be caused either by a low dietary intake of the mineral or the body's poor ability to detain it physiologically.

There are factors that relate the dementias like Alzheimer's with dementias of the vascular type. Studies on cholesterol levels²⁹¹ and on the ratio of saturated fatty acids and

polyunsaturated fats in the diet²⁹² found the metabolism of fats can have an impact on neural-degeneration, noting that a high consumption of saturated fats and cholesterol increases the risk of cardiovascular disease to which the development of dementia can definitely be associated. Hyper-caloric diets,²⁹³ rich in cholesterol and saturated fats and low in fiber, vegetables and fruits,²⁹⁴ can play a role both in the formation of beta-amyloid plaques²⁹⁵ and in causing oxidative damage to neurons.²⁹⁶ A study conducted in 2004, and presented by researchers from Harvard University at the Ninth Annual Conference on *Alzheimer's Disease and Related Disorders*, explored the role played by fruits and vegetables in Alzheimer's disease through the evaluation of dietary habits on the consumption of such foods by 13,000 women between 1984 and 1995, and the correlation of these values with the results obtained through tests of cognitive function conducted between 1995 and 2003, when the women were in their eighth decade of life. The study showed that the elderly women who had consumed more vegetables rich in folate and antioxidants (carotenoids and vitamin C) and leafy green vegetables and cruciferous vegetables (cabbage, broccoli, watercress, turnip and radish) showed less cognitive decline than the women who had consumed less.²⁹⁷

Diet may be able to help reduce the risk of neurodegenerative disorders because many foods might be an important source of compounds with neural-protective activity; this has also been confirmed in experimental and epidemiological studies relating to polyphenols present in green tea and other foods. These studies show that polyphenols can cross the blood-brain barrier, improving age-related cognitive decline and acting as a neural-protectant in the case of Parkinson's disease, Alzheimer's disease and ischemia/reperfusion damage.²⁹⁸

There is also growing scientific interest in the role of homocysteine²⁹⁹ on dementia. Increased levels of homocysteine appear to be an independent risk factor for Alzheimer's disease, in addition to being a risk factor for vascular disease of the central nervous system (another common cause of dementia).³⁰⁰ Although there are hereditary forms, acquired hyper-homocysteinemia is usually the result of low levels of vitamin B12, vitamin B6 and folate, which are necessary for its metabolism.

Good sources of folate include legumes, orange juice, asparagus, walnuts and leafy green vegetables like spinach; vitamin B6-rich foods include whole grains, soy foods, peanuts, walnuts, bananas and avocados; and foods high in vitamin B12 are usually foods and products of animal origin, cereals, fortified soy milk and vitamin supplements.

Additionally, controlling the intake of calories in the diet³⁰¹ seems to have a role in the prevention of neurodegenerative diseases such as Alzheimer's disease. For example, some populations of China and Japan have low average daily caloric intakes (1,600-2,000 calories a day) and a lower incidence of Alzheimer's disease, unlike the inhabitants of the United States or of Western Europe, where diets consist of more than 2,000 calories a day.³⁰²

This observation was confirmed by a study conducted in 2002 on elderly American patients who were followed for four years, on average. The results obtained showed that the risk of developing Alzheimer's disease was higher in patients with an increased consumption of calories, compared to those whose diet was characterized by a limited intake of calories.³⁰³

The results obtained from studies that have been carried out, and those still in progress, will help to identify foods and their key components for developing new strategies for prevention/protection against debilitating neurodegenerative diseases.

THERE IS NOW WIDESPREAD SCIENTIFIC CONSENSUS THAT THE DIET CAN HELP REDUCE THE RISK OF NEURODEGENERATIVE DISORDERS, BECAUSE FOODS ARE AN IMPORTANT SOURCE OF COMPOUNDS WITH NEUROPROTECTIVE ACTIVITY



The Mediterranean diet can protect against the onset of Alzheimer's disease

As already noted, there are numerous international studies that show how changing certain eating habits helps to protect individuals from neurodegenerative, as well as cardiovascular, diseases. One study, published in 2008 in the *British Medical Journal* and based on the analysis of information from seven different studies conducted over the past two years around the world (and in which more than 2 million people were involved), focused on the benefits generated by the so-called "Mediterranean dietary model." The study determined the impact that the Mediterranean diet could have on protecting individuals from neurodegenerative diseases.

Developing a specific scoring for adherence to the Mediterranean diet, research has highlighted that an increase of just two points in one's score can actually translate into a gain in terms of protec-

tion from the major chronic diseases, including cardiovascular disease, but also from those neurodegenerative disorders such as Alzheimer's disease, Parkinson's disease and dementia.

In fact, increasing - even slightly - one's adherence to the dietary habits of the Mediterranean basin can ensure a reduction in cardiovascular disease and cancer of 10% and 6%, respectively, as well as a 13% reduction in the risk of developing other diseases.

Moreover, changing one's diet to include fruits, vegetables, cereals, legumes, fish and olive oil can delay the onset of Alzheimer's disease. The study found that, although 30% of the European population is at risk of developing the disease, for a 90% reduction in the number of patients it would be sufficient to delay the onset of the symptoms for ten years through adherence to a Mediterranean dietary model.

2.5 MAIN EVIDENCE FROM THE INTERNATIONAL LITERATURE ON THE RELATION BETWEEN DIET, PREVENTION AND OSTEOPOROSIS

As highlighted by WHO in its report, *Keep Fit for Life. Meeting the Nutritional Needs of Older Persons*,³⁰⁴ the aging process has consequences on the nutritional needs of the elderly at two levels:

- A decreased caloric requirement per kilo of body weight with age, which reduces the intake requirements of some nutrients;
- And an increase of nutritional requirements for other essential nutrients.

The factors related to diet, aggravated by the changes that occur naturally with the aging process, also appear to be linked to the manifestation of many diseases associated with aging, including osteoporosis.

Although the link between nutrition and osteoporosis, according to studies of this disease, is relatively moderate, the presence in some foods of specific micronutrients, particularly calcium and vitamin D,³⁰⁵ can help prevent osteoporosis because they protect bones.

The growth of the skeleton is completed between 20 and 30 years of age and is followed, in both sexes, by the loss of bone mass. Bone loss is accelerated by menopause in women, nutritional factors, especially calcium and vitamin D, and physical exercise. These factors impact peak bone mass, i.e., the maximum skeletal mineral content, and bone loss associated with age and muscle strength.

Recent studies, including a study conducted by a team of researchers from Europe and the U.S. in 2010 and published in the *British Medical Journal*,³⁰⁶ have shown that a daily intake of vitamin D associated with calcium consumption reduced the risk of fractures by up to 8% and, therefore, is an essential tool for the success of any treatment for osteoporosis.

Calcium is the most important mineral in our body: 99% of it is found in the bones and teeth, while only 1% is found in body fluids. Calcium metabolism is closely related to that of phosphorus and, in the skeleton, the greatest amounts of calcium and phosphorus are present in the form of hydroxyapatite crystals, attached to the collagen fibers. The deposit of these crystals and their orientation are partially governed by the mechanical stresses that the skeleton receives and as a result, extended periods of bed rest or physical inactivity increase the progressive demineralization of bone and can lead to osteoporosis.

The physiological process of mineralization of bone architecture also normally decreases with age, something that affects the manifestation of osteoporosis, especially in women after menopause because of reduced levels of estrogen.

We cannot entirely blame lack of calcium³⁰⁷ for the onset of osteoporosis. Instead, it is due to a combination of environmental, genetic and nutritional factors, but the importance of calcium, especially in the prevention of osteoporosis, is still important when one considers that, in all age groups, the amount calcium consumed each day is actually lower than recommended.³⁰⁸ Although it is recommended that children between the ages of 11 and 17³⁰⁹ consume between



THE GROWTH OF THE SKELETON IS COMPLETE AT AROUND 20-30 YEARS OF AGE, AFTER WHICH THE LOSS OF BONE MASS BEGINS IN BOTH SEXES, BUT AT A HIGHER SPEED IN WOMEN. NUTRITIONAL FACTORS, ESPECIALLY CALCIUM AND VITAMIN D, AND PHYSICAL EXERCISE HAVE MANY EFFECTS: THEY INFLUENCE PEAK BONE MASS, THE BONE LOSS ASSOCIATED TO AGE AND MUSCLE STRENGTH

800 mg (in Europe)³¹⁰ and 1,000 mg (U.S.)³¹¹ for females, and 1,000 mg (in Europe) and 1,300 mg (in the United States) for males, of calcium per day, in Italy, at least 70% of the female adolescents and 60% of the male adolescents ingest doses below those recommended.³¹² In adults, the calcium intake should be around 700 mg (in Europe) to 1,000 mg (in the United States) per day, but only 50% to 60% of the population actually seems to meet these recommendations.

In postmenopausal women (women aged between 51 and 70 years), the recommendations of the Institute of Medicine are for a calcium intake of around 1,200 mg in the absence of estrogen; for women undergoing estrogen therapy, the recommended requirement is equal to that of men over the age of 50 (1,000 mg).

Retrospective studies have shown that individuals who regularly drink milk during childhood exhibit higher bone mass as adults than those who did not follow the same diet.³¹³

This perspective is even more remarkable considering that, in the general population, a 10% increase of peak bone mass could halve the risk of fracture in adult life.

Physical activity, in particular, antigravity activity such as walking, running and dancing, is also a powerful incentive to maintain or increase bone mass: body weight positively stimulates calcification with a consequent increase in bone density. For this reason, the regular practice of physical activity during adolescence and youth encourages the maximum development of bone mineral, thus staving off the risk of osteoporosis later in life. The lack of vitamin D³¹⁴ is also very common in the elderly population and is due to a reduced intake of the vitamin, as well as decreased intestinal absorption, decreased skin synthesis and a reduced conversion to the more active form of the vitamin.

Vitamin D³¹⁵ is a fat-soluble vitamin in the body in the form of:

- Cholecalciferol (D3), synthesized in animals and present in higher amounts in fish oil and egg yolk;
- Ergocalciferol (D2), which is derived from plants and yeasts.

Vitamin D exerts its functions in the intestine by increasing the absorption of calcium and phosphorus in the kidneys, by increasing the reabsorption of calcium while in the bones, preserving normal bone mineralization, and by maintaining constant levels of calcium and phosphorus.

Since most of the vitamin D is synthesized independently by the skin with exposure to the sun, for adults no nutritional recommendations can be made regarding its administration. However, in cases of increased need or decreased synthesis, such as in the elderly, especially if individuals are not regularly exposed to the sun, it is recommended to intervene through a dietary supplementation of approximately 10 mg/day of vitamin D.³¹⁶ Foods with a higher content of the vitamin include liver, fish oils (especially cod liver oil), fatty fish like salmon and sardines, milk and dairy products (especially butter) and eggs. Finally, several studies show that, in addition to calcium and vitamin D, other micronutrients can prevent the onset of osteoporosis by improving the long-term health of the bones.^{317, 318} These are the main antioxidants, substances that can neutralize free radicals and protect the body from their negative action. In conclusion, even though a moderate link between diet and prevention of osteoporosis has been found, as already mentioned, studies agree that prevention should begin at an early age, when the calcium intake through foods is absorbed by the body and contributes effectively to consolidating bone density.

In adulthood and old age, the slowing of osteoporosis cannot be separated from the adoption of a diet characterized by reduced sodium intake, an increased consumption of fruits and vegetables, a minimum intake of 400/500 mg of calcium and the elimination of alcohol, as well as a lifestyle characterized by moderate physical activity, balanced body weight and the elimination of smoking.

Figure 2.4. *Keep fit for life. Meeting the nutritional needs of older persons*

EVIDENCE	DECREASED RISK	NO RELATIONSHIP	INCREASED RISK
CONVINCING older people ^a	Vitamin D		High alcohol intake
	Calcium		Low body weight
	Physical activity		
PROBABLE older people		Fluoride ^b	
POSSIBLE	Fruits and vegetables ^c	Phosphorus	High sodium intake
	Moderate alcohol intake		Low protein intake (in older people)
	Soy products		High protein intake

^a In populations with high fracture incidence only. Applies to men and women older than 50-60 years, with a low calcium intake and/or poor vitamin D status.

^b All levels used to fluoridate water supplies: High fluoride intake causes fluorosis and may also alter bone matrix.

^c Several components of fruits and vegetables are associated with a decreased risk at levels of intake within the normal range of consumption (e.g., alkalinity, vitamin K, phytoestrogens, potassium, magnesium, boron) Vitamin C deficiency (scurvy) results in osteoporotic bone disease.

Source: WHO, 2002.



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3. SUMMARY
OF GUIDELINES
FOR HEALTHY
EATING AIMED AT
PREVENTING
THE ONSET OF
MAJOR CHRONIC
DISEASES

3. SUMMARY OF GUIDELINES FOR HEALTHY EATING AIMED AT PREVENTING THE ONSET OF MAJOR CHRONIC DISEASES

Given the findings from the most authoritative scientific studies, it would be very useful to translate the complex and highly technical scientific evidence about nutrition and well-being into dietary and behavioral recommendations that can be understood by non-specialists.

To do this in a rigorous and scientific manner, we have analyzed the guidelines of the most authoritative international institutions and scientific organizations about proper diet and appropriate lifestyle for the prevention of major chronic diseases, focusing on the most common and serious diseases, including cardiovascular diseases, diabetes and cancer. In many cases, these guidelines represent the best food and behavioral indications to also prevent the onset of neurodegenerative diseases and osteoporosis (although not always specifically mentioning these diseases within the chapter).

By comparing the different food and behavioral recommendations proposed at the international level, a synthesis has finally been produced that is able to show the points of contact between the different approaches for prevention of individual chronic diseases, identifying cross-cutting nutritional and dietary recommendations that, through the close interrelationship between the food choices and lifestyles, may represent a concise and practical tool for the overall prevention of chronic diseases and the attainment of general good health.

The recurring theme of this 16-point handbook, if it is possible to identify one, is represented by the need to adopt a balanced way of eating and living that focuses on prevention of major chronic disease and is characterized by the control of the total calories in the diet, by the appropriate equilibrium of the various macro- and micro-nutrients, and by regular physical activity (even if is limited).

As we have seen, there are many convergent elements in terms of diet for the prevention of major chronic diseases and a joint analysis allows us to define what behaviors and lifestyles to adopt for a healthy diet that specifically prevents the onset of cardiovascular diseases, diabetes and cancer.

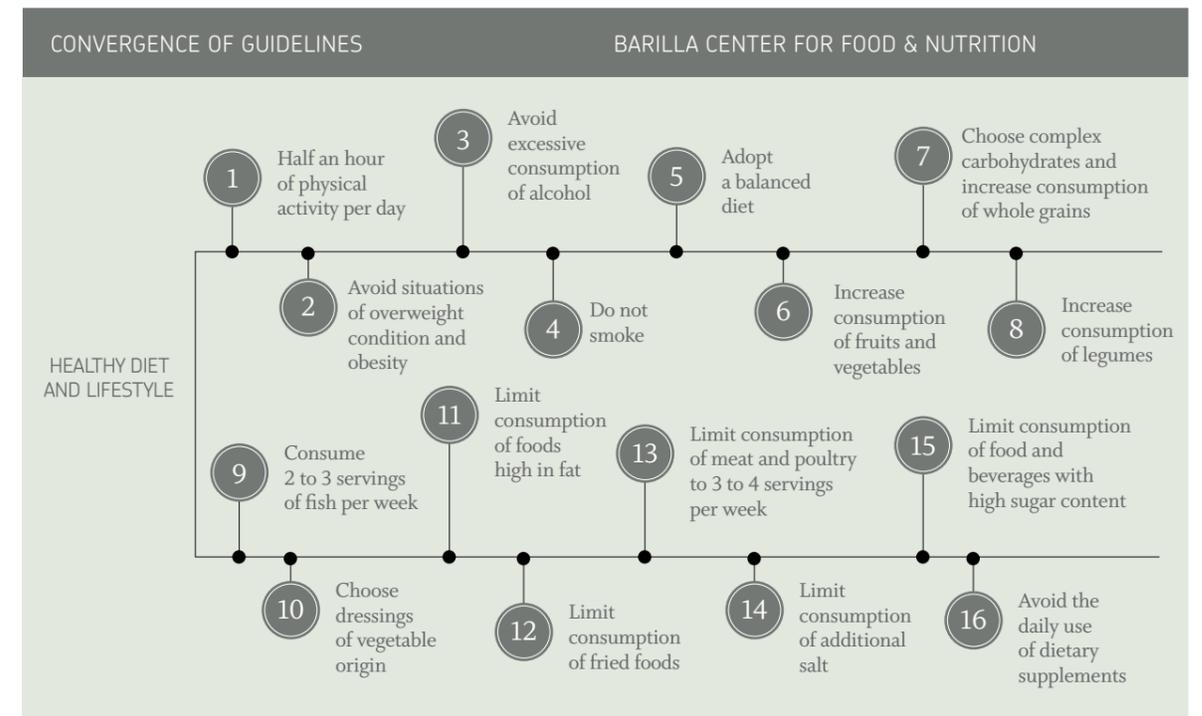
These indications appear to be able to generate, in many cases, positive prevention effects concerning the onset of neurodegenerative diseases and osteoporosis – diseases that tend to be more related to the advanced stages of life.

IN SHORT: ADOPT A "BALANCED" DIET AND LIFESTYLE, CHARACTERIZED BY CONTROL OF THE TOTAL CALORIC INTAKE, AN APPROPRIATE COMPOSITION OF THE DIFFERENT MACRO- AND MICRO-NUTRIENTS AND REGULAR PHYSICAL ACTIVITY

Lifestyles, behavior and diet

1. Engage in regular physical activity for 30 to 60 minutes a day, of medium (walking on foot or bicycling) or high intensity (running, swimming and playing team sports), most of the days of the week.
2. Avoid situations of overweight condition or obesity in both the short and long term (thus avoiding gaining back any excess weight lost).
3. Avoid excessive alcohol consumption (no more than one glass of alcoholic beverages per day for women and two glasses per day for men).
4. Do not smoke.
5. Adopt a balanced diet, characterized by the control of total caloric intake and an appropriate composition of various macro- and micro- nutrients.
6. Increase consumption of fruits and vegetables (up to 400g/day), especially favoring high-fiber foods: eat 4-5 servings of fruits/vegetables a day, especially as a replacement for high-calorie snacks.
7. Choose sources of complex carbohydrates and increase the consumption of whole grains (including bread, pasta and breadsticks made with whole meal flour).
8. Increase the consumption of legumes.
9. Eat 2 to 3 portions of fish per week.
10. Choose vegetable condiments and dressings (vegetable oil) over those high in animal fats (butter and lard).
11. Limit consumption of foods high in fat (such as hot dogs, sauces, creams, cheeses and sausages), preferably choosing lean products (such as yogurt and skim milk).

Figure 3.1. Schematic summary of the methodology followed for the convergence of the guidelines for healthy diet and lifestyle



Source: WHO, 2002.

12. Limit consumption of fried foods.
13. Limit consumption of meat and poultry to 3 to 4 servings per week.
14. Limit additional use of salt with regard to the sodium already found in foods (no more than 5 to 6 grams of additional salt, amounting to about a teaspoon).
15. Limit consumption of foods/beverages with high concentrations of sugar (including bakery products and soft drinks).
16. Avoid daily use of dietary supplements.



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New 2010 Dietary Guidelines for Americans from USDA

The 2010 issue of *Dietary Guidelines for Americans* reflects a comprehensive review of the evidence intended to provide information and advice on the development of healthy eating patterns (<http://www.cnpp.usda.gov/dietaryguidelines.htm>). Two significant components of this publication focus on the achievement and maintenance of a healthy weight, and the consumption of nutrient-dense foods and beverages.

For the past 30 years, the United States Department of Agriculture (USDA) and the Department of Human Health Services (HHS) have shared the responsibility of convening experts to review the scientific literature and providing policy recommendations relative to diet and health. The applications of the ensuing dietary guidelines for Americans extend to multi public health policies and agencies.

In the United States, these recommendations affect food and nutrition programs within the *Supplemental Nutrition Assistance Program* (SNAP; <http://www.fns.usda.gov/snap/snap.htm>), *Women, Infants and Children* (WIC; <http://www.fns.usda.gov/wic/>), and *National School Lunch Program* (<http://www.fns.usda.gov/cnd/lunch/>). The recommendations also impact nutrition labeling of food products, food safety education and various food programs within the *USDA Center for Nutrition Policy and Promotion* (CNPP; <http://www.fns.usda.gov/cnd/lunch/>). One important responsibility of CNPP is consumer education on health through dietary guidance.

A dietary guidelines advisory committee, comprised of experts in nutrition, medicine, public health, and food science, is appointed every five years. The committee's charge is to critically review the

literature through an evidence-based process, and provide recommendations to achieve healthy dietary patterns.

Out of 23 recommendations in the dietary guidelines for people 2 years of age and older and intended to reduce chronic diseases, there are two overarching imperatives:

- Maintain calorie balance;
- and consume nutrient-dense foods and beverages.

The Process

The development process involved three important steps:

- Dietary Guidelines Advisory Committee;
- Review of and Comment on the Dietary Guidelines Advisory Committee;
- and drafting and the *Review of the Dietary Guidelines for Americans*.

Thirteen highly credentialed and experienced experts in public health conducted systematic, evidence-based, systematic reviews on 130 scientific questions, through a public, transparent process that used a Nutrition Evidence Library (www.NEL.gov). This is a store-house of all research protocols, literature selection, evidence summary materials, and graded conclusion statements.

The reviewed evidence, plus public comments, culminated in a 445-page report which was submitted to the USDA and HHS secretaries. This report, in addition to further public comments and internal review by nutritionists and policy makers, was transformed into a 95-page policy document approved by the USDA and HHS. The Nutrition Evidence Library process stipulated several criteria for study inclu-

sion. The general eligibility criteria were:

- Human studies;
- Developed countries;
- English language;
- and peer-reviewed journals, followed by specific search and sort plans pertinent to the identified questions.

The study search criteria considered numerous factors, including:

- Age of subjects (e.g., children, adults);
- Study setting (e.g., hospital vs. free-living);
- Number of subjects per study arm;
- Attrition rate;
- Characteristics of intervention;
- Outcome measures (e.g., validated and clinically relevant);
- and study design (e.g., randomized controlled trial or epidemiological).

The Questions

Prior to initiating a systematic search, specific research questions were developed. A total of 130 questions were approved by the advisory committee and were subsequently distributed to the respective subcommittees. The PICO (Population, Intervention, Comparator, Outcomes) approach plus identification of inclusion and exclusion criteria were strategically assessed for each search of the literature. Questions, which were extensions of the 2005 dietary guidelines, examined literature from 2004 through 2009. For questions not addressed by the 2005 dietary guidelines committee, the data range was typically extended based on expert opinion and exploratory literature searches.

Maintain Energy Balance

Calorie balance over time is the key to weight management. Many recent surveys indicate that about 60% of the adult population does not understand calories or energy balance. Thus, many consumers do not recognize the association

between food and beverage intake and body weight. In addition, physical activity must be considered when addressing weight management. Importantly, there are many health benefits associated with physical activity that are independent of body weight.

The top five sources of calories in the American diet are grain-based desserts, yeast breads, chicken and chicken mixed dishes, soda/energy/sports drinks, and pizza. Foods that contribute the greatest number of calories differ by age group. For example, alcoholic beverages are a major calorie source for adults, whereas fluid milk is a top calorie source for younger children. Yet, the evidence indicates that too few children consume milk, of which the low-fat and non-fat forms provide an array of important nutrients. Behaviors and dietary practices are important components to monitor that can help people manage their energy intake and calorie expenditure. Central to these elements is the reduction of portion sizes, especially of foods that are high in calories, and improved food choices when dining outside the home. Other elements include a reduction of screen time, whether it is television or computers, and increased physical activity.

Nutrient-dense Foods

Most common foods are energy rich instead of nutrient dense. Nutrient-dense foods are those rich in vitamins, minerals, and phytochemicals. These foods are also lean or low in solid fats and without added solid fats, sugars, starches or sodium and those that retain naturally-occurring components, such as fiber. For example, all vegetables, fruits, whole grains, fish, eggs and nuts, prepared without added solid fats or sugars, are considered nutrient-dense. Importantly, lean meats, poultry and nonfat or low-fat forms of fluid milk are also considered nutrient-dense foods.



DASH (Dietary Approaches to Stop Hypertension) and traditional Mediterranean-style eating patterns and some for vegetarian diets.

Recommendations in Review

This chart shows how the average American diet compares to recommendations found in the 2010 Dietary Guidelines.

This chart shows that whole grains, vegetables, fruit, dairy products (low and nonfat), seafood (primarily fish) and oils are consumed below recommended amounts. It also illustrates that fiber, potassium, vitamin D and calcium are nutrients of concern. Excessive amounts of solid fats and added sugars, refined grains and sodium are clearly above recommended limits.

Making Healthy Choices

There are two major concepts that encourage consumers to make healthy choices:

- The current food and physical activity environment is influential in the nutrition and activity choices that people make;
 - and all elements of society have a positive and productive role in the movement to make America healthy
- Within the social-ecological framework for decision making, there are four points of influence to consider. Those points are:
- Social and cultural norms and values, which include belief systems, heritage, religion, priorities, lifestyle and body image;
 - Sectors of influence, which include government, public health and health care systems, agriculture, marketing and media, community design and safety, foundations and funders, and industry, including food, beverage, physical activity, and entertainment;

- Environmental settings, which include homes, schools, workplaces, recreational facilities, foodservice and retail establishments, and other community settings;
- and individual factors, which include demographic factors, psychological factors, knowledge and skills, gene-environment interactions, and other personal factors, plus food and beverage intake and physical activity.

Research Recommendations

The Dietary Guidelines Advisory Committee identified more than 70 research recommendations.

Three of those recommendations included the following:

- Polyphenols (phytochemicals): there is a need to assess their impact on health, including pharmacokinetics and classic ADME (Absorption, Distribution, Metabolism, Elimination) studies. Food examples include chocolate, nuts, fruit, vegetables, seeds and grains. At the same time, it is important to consider the composition of the whole food.
- Genetics: there is emerging evidence that indicate personal genetics and the dynamics of epigenetics and nutrigenomics impact health. Two examples of genetic polymorphisms include FADS (fatty acid desaturases 1 and 2) and APOA1/C3/A4/A5 that affect apoproteins and postprandial fatty acid clearance rate. These polymorphisms may impact benefits and risks associated with fatty acid consumption.
- Probiotics and Prebiotics: there is strong emerging evidence that the human microbiome has a significant impact on health. The consumption of some strains of probiotics and some forms of prebiotics may confer some health benefits, particularly in some population subgroups, such as infants, children and seniors.

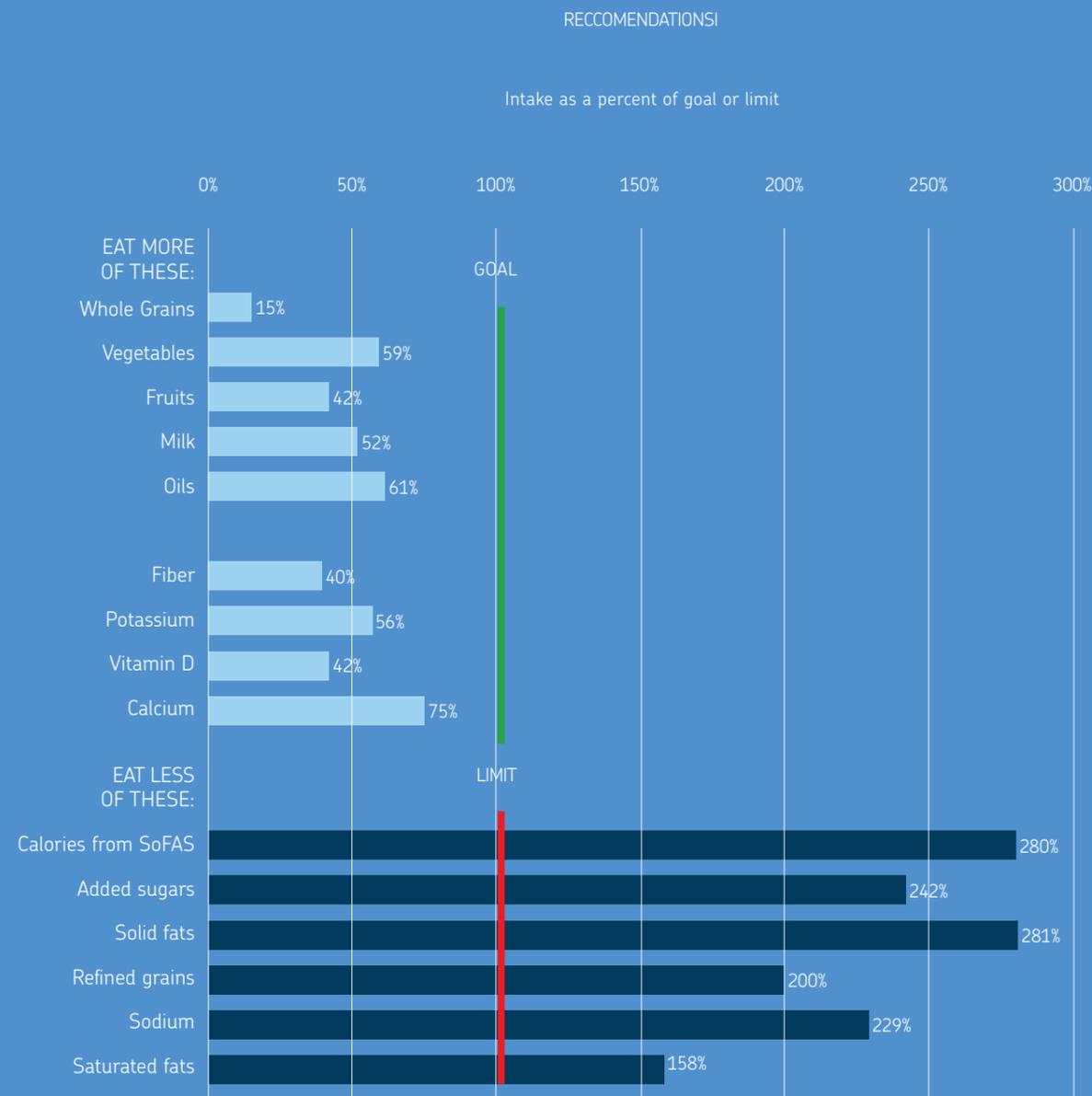
Summary

The 2010 Dietary Guidelines for Americans provide evidence-based recommendations on nutritional guidance that do the following:

- Promote health;
- Reduce the risk of chronic diseases;
- and reduce the prevalence of overweight and obesity.

The guidelines attempt to integrate a set of dietary advice that provides flexibility in eating patterns in an effort to achieve overall health. To receive the full benefits of the Dietary Guidelines, consumers are advised to comply with all of the recommendations, particularly in maintaining appropriate energy intake and consuming nutrient-dense foods.

Figure 3.2. Dietary Guidelines for Americans (2010)



Source: WHO, 2002.

What is the relationship between diet and health in the early stages of life? *Food for Growth*¹

In Western countries, a high number of deaths in adulthood are linked to problems arising from an excess of food, bad eating habits and lifestyles that, in many cases, began at an early age.

On the one hand, we know that childhood obesity is a serious risk factor for obesity in adulthood.

On the other hand, lifestyles and behaviors that are acquired in childhood, such as food preferences, diet composition and distribution throughout the day of eating, along with the acquisition of an active/sedentary lifestyle, can help to induce an overall appropriate/inappropriate eating behavior in adulthood, because of a memory effect related to acquired habits.

It is therefore important to pay attention, starting early in childhood, to the adoption of appropriate eating behavior, in terms of daily healthy eating habits and lifestyles.

Some of the root causes of overweight conditions and obesity are scarcely, or not at all, sensitive to preventative or therapeutic interventions because they are related to genetic factors, while others can respond to preventive actions aimed at changing certain behaviors of lifestyle, eating habits and physical activity. However, in order to be maximally effective and durable, these interventions must begin at the earliest stages of life.

As noted by Claudio Maffeis at the Second International Forum on Food and Nutrition, “the first years of life are a very important window of time in the development of the organism. [...] Eating well during the time of growth is very useful because it not only ensures [correct] growth and development in children, but also a defense against disease and metabolic problems one may encounter later in life.”

Given the importance of nutrition during adolescence, especially in the prevention of major chronic diseases, governments and international organizations dealing with health issues have formulated guidelines for the definition of a balanced diet at the different stages of life of the individual, focusing specifically on adolescence.²

In general, with regard to the breakdown of the different meals during the day, it is necessary to remember that nutritional science indicates five key moments for the intake of food by the child.

An appropriate weekly composition may be approximately as follows:

- Cereals (bread and pasta), daily;
- Fruits and vegetables every day;
- Milk and dairy products, daily;
- Meat, two to three times during the week;
- Fish, at least 3 times per week;
- Cheese, 2 times per week;
- Eggs, 1 to 2 times per week;
- Legumes, at least 2 times per week.

In addition to the more strictly nutritional information, it is necessary to remember that regular physical activity (done mostly in the open air) is one of the factors considered crucial to the health of children and adolescents (it also has an important positive impact on reducing the risk of onset of major chronic diseases in later life, up to adulthood).

A basic condition for a healthy diet is variety. Children and adolescents can easily get the nutrients needed for growth from a varied diet.

In summary, the guidelines that should be followed for adopting a healthy diet and correct lifestyle to help healthy adolescent development are as follows:

- Adopt a healthy and balanced diet that, daily, alternates all the main foods and that provides all the nutrients and micronutrients (calcium, iron, vitamins, etc.) that the adolescent needs;

- Avoid the excessive intake of calories, eating high-calorie foods, or foods with high concentrations of fat;
- Maintain a balance of nutrients throughout the day, ensuring that there is a balance between the consumption of animal and vegetable proteins that must be equal to 1, of simple and complex sugars (by consuming less sweets, more bread, potatoes, or pasta or rice), of animal and vegetable fats (using less lard and butter and more olive oil);
- Reduce additional salt to a minimum to reduce the risk factors for developing hypertension, especially in adulthood;
- Distribute the eating of food to five times throughout the day (breakfast, morning snack, lunch, snack and dinner);
- Avoid eating food outside of the five times previously identified;
- Engage in physical activity for at least an hour a day, including both sports and play;
- Minimize sedentary life, especially time spent in front of the video screens (television and computers).

What is the relationship between diet and health in old age? *Nutrition for longevity*³

According to UN estimates, in 2025 there will be more than 8 billion people in the world, which is mainly due to the general increase in life expectancy.

In the last hundred years, life expectancy at birth has almost doubled, from 45 years in the late nineteenth century to about 80 years in 2010. The percentage of older people has increased strikingly; for example, in Italy, the percentage of older people has risen from 4% in 1900 to 20.6% in 2010. In 2050, in Italy people aged over 65 will account for 34% of the population: one in three people will be elderly, and this trend is also being recorded worldwide.

In the period from 1950 to 2010, the elderly population grew globally at an average annual rate of 13%, and shows no indication of stopping: indeed, it is estimated that by 2050, the population over-65 years of age will consist of 1.9 billion people.

These demographic changes are very worrying and could undermine the health systems of many countries, both industrialized and developing: in fact, about 80% of older people (aged over-65 years) suffer from at least one chronic disease and about 50% have two or more chronic diseases (such as cardiovascular and cerebrovascular diseases, cancer, diabetes mellitus, hypertension and chronic lung disease).⁴

These numbers are bound to grow, in light of the epidemic of obesity and diabetes that is currently in progress, even among younger age groups of the population. Overweight conditions and obesity (especially abdominal weight gain) is associated with an increased risk of developing cardiovascular disease and cancer which, together, are responsible for about 70% of the causes of death in many industrialized and developing countries.

In light of these demographic changes, including the epidemic of obesity and the deterioration in lifestyle (sedentary lifestyle, calorie-rich food, and tobacco consumption), it becomes important to study and implement interventions aimed at the prevention of the chronic diseases associated with aging and at improving the quality of life and reducing the gap between the length of life (lifespan) and the duration of healthy life (healthspan). It is necessary to identify and adopt lifestyles that promote growing old in a healthy way (healthy aging or successful aging), ensuring that individuals can remain physically and mentally healthy, happy, active, strong, independent and socially useful for the longest possible time, ideally for the duration of their lives.

EATING WELL DURING THE TIME OF GROWTH IS VERY USEFUL BECAUSE IT ENSURES PROPER GROWTH AND DEVELOPMENT IN CHILDREN AND IS ALSO A DEFENSE AGAINST METABOLIC DISORDERS AND DISEASE IN LATER LIFE

THE ELDERLY POPULATION HAS GROWN WORLDWIDE WITH A TREND OF CONTINUOUS GROWTH: IT IS ESTIMATED THAT IN 2050, THE POPULATION AGED OVER-65 WILL CONSIST OF 1.9 MILLION PEOPLE. THIS GROWTH WILL UNDERMINE MANY COUNTRIES, BECAUSE ABOUT 80% OF THE ELDERLY (AGED > 65) IS SUFFERING FROM AT LEAST ONE CHRONIC DISEASE AND ABOUT 50% IS AFFECTED BY TWO OR MORE CHRONIC DISEASES

SCIENTIFIC EVIDENCE HAS SHOWN THAT A MODERATELY HYPERCALORIC DIET RICH IN NUTRIENTS IS ABLE TO SLOW DOWN THE AGING PROCESSES AND PREVENT MOST OF THE CHRONIC DISEASES ASSOCIATED WITH AGING

Without corrective action on lifestyles, longer life may no longer mean achieving a better life and we may experience, on average, an old age characterized by a greatly reduced quality of life for a significantly longer time.

To be able to achieve this ambitious goal, it is necessary to address the problem of aging and the diseases associated with aging with a preventive and integrated approach because the choice to fight a single disease only when it comes to the doctor's attention is conceptually wrong and leads to not adequately addressing the challenges of reducing the gap between lifespan and health span.

Aging, in fact, is a process caused by the progressive accumulation over time of damage to the DNA, of cells, and organs throughout the body, due to failure of repair mechanisms. The accumulation of this damage causes a progressive decline of many physiological functions and vital structures of the body.

Recent studies have demonstrated that lifestyles (nutrition, physical activity, exposure to cigarette smoke and toxic, radioactive and polluting substances) heavily influence the aging processes. For example, a high caloric diet, rich in animal fats and low in nutrients (vitamins, minerals, etc.) and a sedentary lifestyle promote the onset of obesity, diabetes mellitus, hypertension, cardiovascular disease and cancer, and an acceleration of aging processes. In contrast, much scientific evidence has shown that a moderately low-calorie diet, rich in nutrients is capable of slowing down the aging process and preventing most of the chronic diseases associated with aging.

While we cannot prevent or reverse the natural aging process, we can take decisive action on environmental aging (or secondary aging) and influence the intrinsic processes of aging (or primary aging), slowing down the natural aging process and, more importantly, acting on the chronic diseases associated with them including obesity, diabetes, metabolic syndrome, cancer, cardiovascular diseases, hypertension, and inflammatory processes).

In this context, there is clearly a central role played by nutrition and lifestyle in preventing the onset of these diseases, in mitigating their effects, and then, ultimately, in promoting longevity that is qualitatively better.

In particular, it is possible to consider that different interventions and approaches effectively contribute to slowing down the aging process when they are able to simultaneously extend the average life expectancy and the maximum life expectancy of an organism. Likewise, these approaches, decelerate numerous structural and physiological changes (dependent on age) in organs and tissues.

In light of this, authoritative studies have shown that the adoption of an overall healthy lifestyle and, in particular, of an adequate diet may ultimately constitute a significant intervention in favor of healthy longevity, confirming the fact that much can be done to prevent and mitigate the negative effects that many factors, including chronic diseases, have and will have on longevity and quality of life.

Two recent areas of research – inflammatory states and caloric restriction – will, in the near future, be able to give further evidence or open new scenarios for understanding the possibility of living better and longer.

In relation to inflammation, it is important to emphasize that the potential longevity of each individual is closely linked to the proper functioning of the cells, which protect and make continuous repairs in the body. These cells may, however, exhaust their replication capacity, and therefore their reparative potential, more or less quickly in life, depending on several factors. The depletion of the ability to reproduce the cells used in the repair processes leads to the gradual emergence of inflammatory and degenerative phenomena such as arteriosclerosis. Some chronic degenerative diseases can result from a progressive inability to cope with situations of constant inflammation and the progressive failure of the repair

processes (neurodegenerative diseases). Other diseases and health conditions such as diabetes and obesity, instead, produce an inflammatory condition in the blood and tissues capable of generating a more intense use of the healing processes, and causing their early exhaustion, which results in a shortening of life expectancy.

Recent scientific studies have emphasized the link between different diseases and the chronic state of silent inflammation generated by the adoption of inappropriate dietary habits. It has been shown that the type of diet adopted can positively or negatively affect the body's inflammatory responses.

If the level of inflammation is low, i.e., without pain or silent, the prolonged presence of this level of inflammation results in a faster consumption of the body's repair processes. Ultimately, this has an impact on the emergence of chronic diseases and, therefore, on the longevity and the quality of life of the population.

In the past, it was well known that wounds or microbial attacks were due to the inflammatory responses of the organism. Current studies, however, show how dietary patterns may also influence these inflammatory responses positively or negatively.

Therefore, silent cellular inflammation becomes the origin of various chronic diseases. Levels of inflammation, caused by type of diet adopted, imply a remedial action of the organism in which a primary role is played by the telomeres. As previously mentioned, the greater frequency and intensity with which telomeres are called upon to perform repairs, the greater the speed with which they become exhausted. The diet adopted by individuals in a population becomes an important factor in the treatment of inflammatory states produced by situations of obesity,⁵ diabetes and the presence of cardiovascular disease.

In light of past and on-going research studies, on the influence of diet on health, we can say that caloric restriction without malnutrition (understood as a reduction in energy intake up to a limit of 50%, but with an adequate intake of vitamins and minerals) turns out to be one of the most powerful interventions to slow aging and increase the lifespan in many animal models.⁶ Hundreds of studies on animals have shown that caloric restriction prevents or slows the onset of most chronic diseases associated with aging and extends the life span up to a maximum of 50%.⁷ for example, caloric restriction drastically reduces (up to 60%) the risk of developing cancerous tumors (which are the leading cause of death in rodents).⁸

Finally, as shown by some studies⁹ in mammals, aging is not inevitably associated with the onset of chronic diseases and it is possible to live a long life without getting sick, and other studies currently in progress are aimed at understanding the metabolic and molecular mechanisms underlying this phenomenon.

The mechanisms underlying the anti-aging effect of caloric restriction are complex and not fully understood. In general terms, reducing calorie intake (but with an adequate and proper supply of nutrients) slows down the aging process and enhances the systems delegated to repair the damage: in a way, nature is put into a state of standby and protection if it perceives a lack of nourishment.

A recent study showed that a 30% reduction in energy intake for 20 years in monkeys is able to reduce the mortality rate for cancer and cardiovascular disease by 50%. The monkeys on caloric restriction in this study were also completely protected against obesity and diabetes mellitus. The researchers have also demonstrated a significant slowing of the atrophy of certain areas of the brain in the monkeys subjected to caloric restriction in comparison to those who ate ad libitum.

It is not yet known whether a regime of calorie restriction with the adequate intake of all essential micronutrients would be able to slow aging in humans. In addition to the many positive effects found in studies thus far, caloric restriction may, in turn, lead to serious damage to one's health.

RECENT SCIENTIFIC STUDIES HAVE SHOWN THE LINK BETWEEN DIFFERENT CHRONIC DISEASES AND THE STATE OF "SILENT" INFLAMMATION GENERATED BY THE USE OF IMPROPER DIETARY MODELS CAN POSITIVELY OR NEGATIVELY AFFECT THE THE INFLAMMATORY RESPONSES OF THE ORGANISM

THE ANTI-AGING MECHANISMS OF CALORIC RESTRICTION ARE COMPLEX AND NOT YET FULLY UNDERSTOOD. IN GENERAL TERMS, IN PRESENCE OF A REDUCTION IN CALORIE CONSUMPTION, WITH A PROPER INTAKE OF NUTRIENTS, THE BODY SLOWS DOWN THE AGING PROCESS AND STRENGTHENS THE SYSTEMS DESIGNATED TO REPAIR THE DAMAGE

4. ADHERENCE OF
THE MOST COMMON
FOOD MODELS TO THE
GUIDELINES IDENTIFIED
FOR WELL-BEING



4. ADHERENCE OF THE MOST COMMON FOOD MODELS TO THE GUIDELINES IDENTIFIED FOR WELL-BEING

THE INDICATIONS BY THE MOST INFLUENTIAL SCIENTIFIC COMPANIES – DESPITE THEIR BROAD CONVERGENCE – CANNOT, HOWEVER, LEAD TO THE IDENTIFICATION OF A SINGLE CORRECT DIET. REASONS RELATING TO THE TYPE OF TERRITORY, FOOD TRADITIONS, HABITS AND CUSTOMS OF EACH COUNTRY MAKE IT UNREALISTIC AND, IN ANY CASE, WRONG TO EXPECT THE SPREADING OF A SINGLE IDEAL DIET

The summary of the guidelines described throughout the paper has led to the identification of a set of behaviors that can be used to prevent the onset of chronic diseases. The guidelines and instructions provided by the most authoritative international scientific societies – even in their broad convergence –, however, cannot lead to the identification of a single hypothetical perfect diet, able to guarantee healthy development during childhood, maximum health and disease prevention, and longevity and good health in old-age. In fact, diet is dependent on the type of land in a particular country, food traditions, and habits and customs in specific regions of the world,¹ which make it impossible to spread just one ideal diet.

The comparative analysis of international guidelines has made it possible to demonstrate a substantial convergence of dietary habits useful for the prevention of cancer, cardiovascular disease and diabetes, as well as neurodegenerative diseases and osteoporosis. These analyses outline a fundamental starting point for developing more effective and uniform prevention strategies.

Through an effort of simplifying, and delineating trends on a global scale, it is possible to identify three major global diet traditions, each characterized by their own particular features: the *Mediterranean model*, the *North American model*, and the *Asian model* (which includes a number of important traditions and cultures, from Japan and Vietnam to China). The *Mediterranean diet* is the dietary model used predominantly in Mediterranean countries, especially Italy, Spain, Portugal, Greece and France. It is a dietary model that is characterized by nutritional balance. Its first four components (fruits, vegetables, cereal products, especially grains, and milk products) have a balanced distribution in terms of both the quantity eaten (200 to 260 grams per day per food item) and in relation to the daily consumption (the sum of the first four components is greater than 40% daily).

In general, the close consistency with the recommendations suggested at the scientific level, make the Mediterranean model one of the most effective diets, in terms of wellness and disease prevention.

The *North American diet* is the dietary model prevalent in the United States and Canada and has long been of concern to the scientific world because of the serious phenomenon of the exponential growth of obesity and metabolic disorders in the United States.

This seems to depend on an excess of food consumption (approximately 2,600 grams compared to about 2,000 grams daily of the Japanese and Mediterranean models) and an unbalanced nutritional composition that includes excessive consumption of red meat and sweets, 11.7% and 7.1% of the daily total respectively.²

It is, in essence, a diet mostly rich in proteins and sugars, not adequately counterbalanced by a good level of consumption of fruits and vegetables. These characteristics

mean that the North American diet deviates considerably from the recommendations and guidelines by major international scientific experts and calls for it to be revised and supplemented today.

The *Japanese diet*³ – as an example of the food style prevalent in Eastern Asia – prefers the consumption of cereals, equal to some 24% of the daily total, and fish consumption that is equivalent to 107 grams daily, which is in excess of the 45 grams recommended in the Mediterranean diet and to the 18 grams of fish suggested in the North American diet. In terms of food components, the Japanese diet is very similar to the Mediterranean diet. In addition, the Japanese diet, like the Mediterranean diet, recommends relatively little frying of food. The Japanese diet is characterized by its wealth of minerals, omega-3 fatty acids and phosphorus, resulting mainly from eating fish.

This shows that there can be food styles that are very different from one another, but that are able to adhere to the principles recommended by medical science.



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4.1 THE MEDITERRANEAN DIET AND THE MEDITERRANEAN ADEQUACY INDEX

The idea and concept of the Mediterranean diet was created in 1939 by Lorenzo Piroddi, a nutritionist who was the first to understand the connections between diet and diabetes, bulimia and obesity.⁴

Later, in the 1950s, Ancel Keys,⁵ a physician-scientist at the School of Public Health of the University of Minnesota, was on vacation in Italy and noticed something that seemed very strange at the time: people less well-off (or the so-called “poor”) of the smaller towns in South Italy, who ate mainly bread, onions and tomatoes, were not only much healthier than the citizens of New York, but also than their own relatives who had emigrated years earlier to the United States.

The nutritional value of the Mediterranean diet has been scientifically demonstrated by the famous *Seven Countries Study*,⁶ by Keys, in which the diets eaten by the populations of seven countries were compared to assess their benefits and weaknesses.

From the results obtained from the study, associations between the type of diet and the risk of chronic diseases were discovered:⁷ for example, the high level of saturated fatty acids and cholesterol in the blood is a factor that is both able to explain the differences in mortality rates and to predict the future rates of coronary heart disease in the populations that were analyzed.⁸

The end result of this study indicated that the best diet was that of the inhabitants of Nicotera in Calabria, who adopted a Mediterranean eating style. The population of Nicotera, of Montegiorgio (in the Marche region) and the inhabitants of Campania had a very low rate of cholesterol in their blood and very low rates of coronary heart disease because their diet is based on olive oil, bread, pasta, garlic, red onions, herbs, vegetables and little meat. In general, what emerges is that the adoption of a Mediterranean diet, or one similar to the Mediterranean model, represents a protective factor against the most common chronic diseases. In the studies, the Mediterranean diet is characterized by the following: high consumption of vegetables, legumes, fruits and nuts, olive oil and cereals (which, in the past, were mostly whole grain); a moderate intake of fish and dairy products (especially cheese and yogurt) and wine; and a low consumption of red meat, white meat and saturated fatty acids.⁹

Also in the studies of Panagiotakosa,¹⁰ research found that an increase in the level of adherence to the Mediterranean diet is a significant predictor of hypertension, hypercholesterolemia, diabetes and obesity in adults. An increase of approximately 20% in adherence to Mediterranean diet¹¹ reduces the occurrence of cardiovascular disease by 4% over ten years.

Other studies conducted by Trichopoulou¹² have shown that adherence to a Mediterranean diet produces significant reductions in overall rates of mortality of the population,

especially in deaths as a result of cardiovascular disease and cancer. The same results are also found in the recent studies by Mitrou,¹³ conducted for ten years on a sample of more than 380,000 Americans.

For coronary heart disease, De Lorgeril¹⁴ showed that the Mediterranean diet reduced the risk of heart attack by 72%. In his later work, which was published recently, De Lorgeril shows how the adoption of the Mediterranean diet is a factor able to reduce the occurrence of thrombosis, myocardial infarction and other complications.¹⁵

The results of studies by Fung¹⁶ have also confirmed the cardio-protective effects of the Mediterranean diet. In a recent meta-analysis by Sofi,¹⁷ the Mediterranean diet was found to have a protective factor against all causes of mortality and, specifically, to those related to cardiovascular disease and cancer, but also for Alzheimer’s and Parkinson’s diseases.

The reduction of the likelihood of the onset of chronic diseases overall as a result of adherence to the Mediterranean diet is also supported in a study that investigated the relationship between adherence to the Mediterranean dietary model and longevity in the elderly. The study, analyzing a sample of 1,037 individuals over 70 years of age, stressed that the adoption of the Mediterranean diet increases longevity in individuals.¹⁸

Despite the results of these studies indicating that the best dietary model for good health is the Mediterranean diet, we have witnessed a gradual abandonment of this diet in favor of less healthy eating habits.

In a recent study about Spanish and Italian diets, Baldini¹⁹ shows how the younger generations are gradually phasing out the Mediterranean diet, in favor of new diet trends that are characterized by foods high in fat. Overweight and obesity conditions in Italy and Spain seem to be related not only to reduced physical activity, but also to the abandonment of the Mediterranean diet.

In conclusion, according to research and consensus by the most influential international scientific organization, the Mediterranean diet is consistent with the guidelines on nutrition for the prevention of major chronic diseases. These studies represent a vast and consolidated scientific basis, a reason why the Mediterranean diet model is an important reference point for the numerous studies on the relationship between nutrition and chronic diseases.

As we have seen, the abandonment of the principles of the Mediterranean diet is a worrying trend that has been recorded in recent years, even in Italy.

DESPITE THE FACT THAT THE RESULTS OF THESE STUDIES INDICATE THAT THE DIETARY MODEL TO STRIVE FOR A HEALTHY LIFE IS THE MEDITERRANEAN DIET, SINCE THE FIFTIES UP TO NOW, THROUGHOUT THE MEDITERRANEAN BASIN, INCLUDING ITALY, THERE HAS BEEN A GRADUAL ABANDONMENT OF THIS DIET IN FAVOR OF LESS HEALTHY EATING HABITS

5. COSTS AND
BENEFITS OF
INVESTMENTS
IN PREVENTION



5.1 COSTS AND BENEFITS OF INVESTMENTS IN PREVENTION

THE OECD DEFINES "EXPENDITURE FOR PREVENTION" AS THE SERVICES PROVIDED TO IMPROVE THE OVERALL HEALTH OF THE POPULATION, AS DISTINGUISHED FROM CURATIVE SERVICES

According to the OECD, "expenditure on prevention" includes services provided to improve the overall health of the population, rather than curative services. Typical preventive services include vaccination campaigns, screening programs and policies of public awareness, for example, in the promotion of healthy lifestyles. The OECD points out that this same classification doesn't include all areas related to public health in the broadest sense, such as environmental protection, whereas other official sources taking into account a broader definition of health services for prevention, reach a higher value in terms of expenditure.¹

The choice of using the data provided by the OECD was dictated both by the need to ensure an acceptable degree of international comparability of data, and by the fact that the classification of expenditure used in prevention fits more closely to the purpose of this paper. The analysis takes into account the expenditure for prevention as a whole, not only the prevention that results from dietary choices. This methodological choice is based on two considerations:

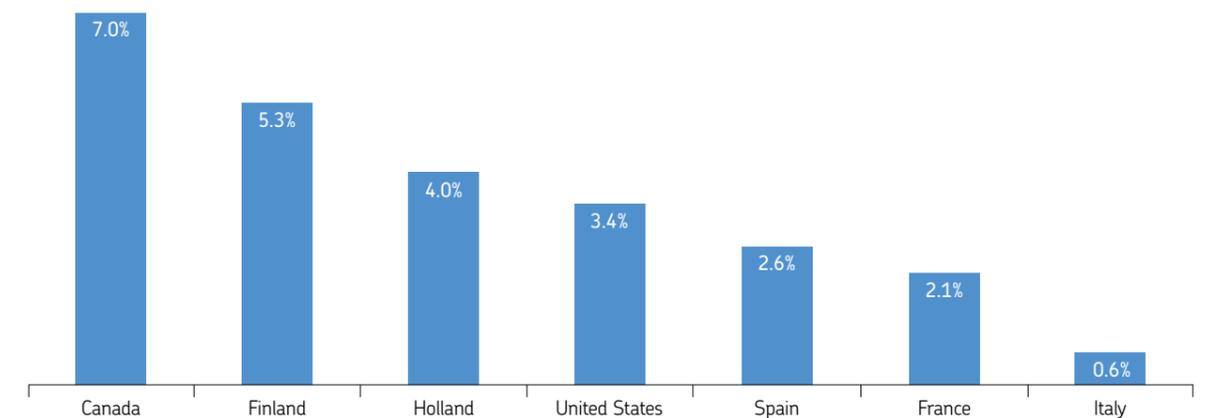
The first is the close relationship between good nutrition and "non-food" prevention (screening programs, control of risk factors for major chronic diseases, medical counseling for the definition of the optimum nutrition plan specific to each individual, etc.). The second, purely technical, is the impossibility of being able to statistically measure the following:

- The share of spending on prevention directly invested for only medical-diet aims in the strictest sense;
- Health improvements in individuals (and in public health expenditure) due only to dietary changes (composition of their daily diet), excluding the competing effect on the final result of these activities defined above as "non-food" prevention. The only observable variable in the long run (needed for measuring changes related to prevention) is reducing the incidence of chronic diseases in the population and the consequent reduction in medical care. The "composition" inside this effect is not measurable in a detailed manner.

As shown in Figure 5.1., in Italy, spending on prevention, compared with other countries, accounted for a marginal share of public health expenditure. In 2009 it was equal to 0.6% of public health expenditure, compared to 7% in Canada, 4% in Holland, 3.4% in the United States, 2.6% in Spain and 2.1% in France.

The objective of the analysis was to estimate the magnitude of the benefit on health from increased expenditures in prevention and the reasons for the delay in its manifestation on the basis of the empirical evidence found at the international level. In particular, the analysis involved five OECD countries, including Canada, France, Holland, Spain and the United States.²

Figure 5.1. Expenditures on prevention as a percentage of total public health expenditure in selected countries (2009)



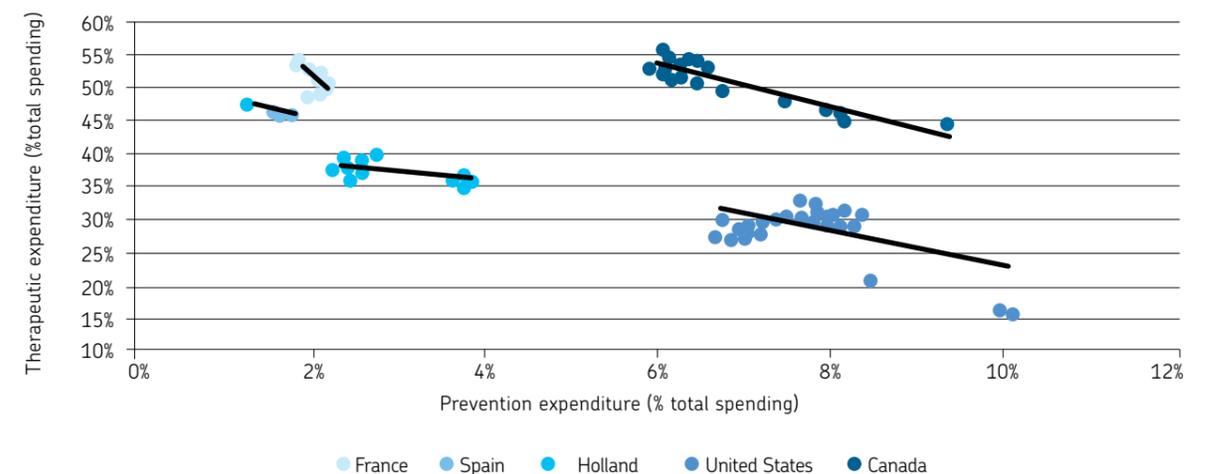
Source: elaboration by The European House-Ambrosetti of data by the OECD, *Health Data 2011*, January 2012.

The criterion for classification adopted by the OECD is based on the definition of prevention as distinct from curative health services, and to estimate the benefit of an investment in prevention, the correlation of spending on prevention and spending on therapeutic and rehabilitative services was analyzed.

From an analysis of the time series (Figure 5.2.), we can deduce an inverse relationship between increased spending on prevention and spending on curative and rehabilitative services in subsequent years. In particular, a 1% increase in spending on prevention of public health expenditure is related to a decrease of 3% in the percentage of expenditure on curative and rehabilitative services.

Taking into consideration different time horizons for the manifestation of benefits, the best statistical correlation between the change in the percentage of the expenditure on prevention and the change in spending on therapeutic-rehabilitative services occurs within a period of 10 years.

Figure 5.2. Correlation between prevention expenditure and therapeutic expenditure

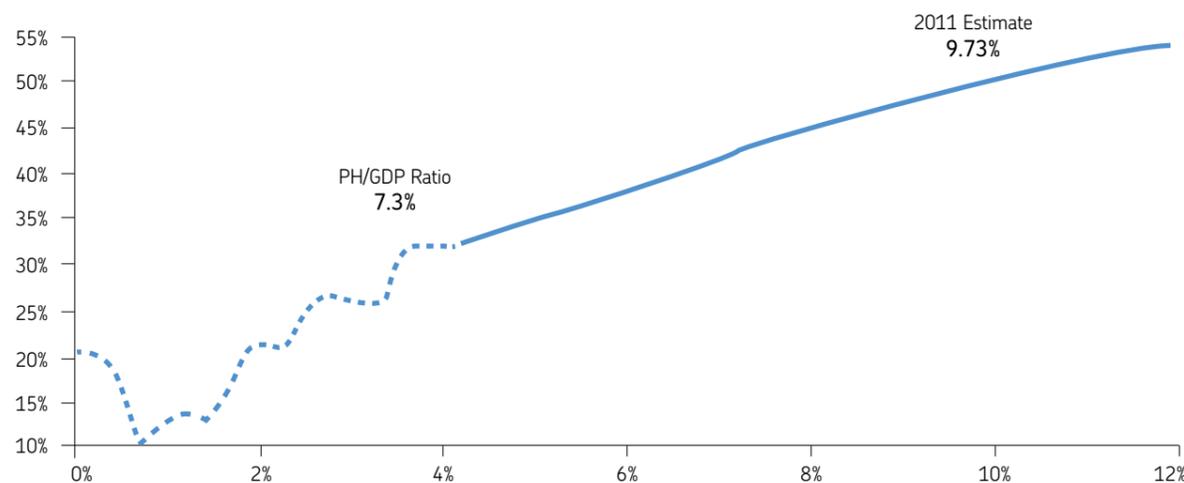


Source: The European House-Ambrosetti, *Health Meridian - the coordinates of health. Final report. November, 2011.*

In conclusion, the analysis of the time series reveals a multiplier for expenditures in performance of the treatment and rehabilitation type that is equal to -3 times the investment made in prevention and the maximum manifestation of the benefit within a period of 10 years.

The results of the analysis on the time series at the international level were then applied to the projected public health expenditure in Italy in 2050. As a result of the demographic and economic component,³ public health spending in 2050 has been estimated at over €281 billion, 9.7% of GDP in 2050 (Figure 5.3.).

Figure 5.3. Prediction model of the public health expenditures in Italy (2050)



Source: The European House-Ambrosetti, *Meridian Health – health coordinates. Final Report, November 2011.*

To estimate the impact of increased investment in prevention, the following hypotheses have been defined:

- A multiplier for expenses concerning the therapeutic-rehabilitative treatment that is -3 times the investment made in prevention;
- A manifestation of the benefits within a period of 10 years;
- The impact of the benefits as a reduction in expenses for the Acute Care Hospital;⁴
- The constancy of the multiplier compared to the absolute value of the investment in prevention.⁵

The level and mode of investment in prevention choices are arbitrary in nature. As a base, we have assumed a structural increase in the ratio of spending on preventive public health to be 1% every 10 years.

In Italy's case, this means that an investment in prevention of €1,135 million (1% of public health expenditure) today will mean a benefit within 10 years of €3,518 million (2.4% of health expenditure planned for 2020).

5.2 A CONCRETE EXAMPLE

An illustrative example of how these benefits can be achieved is by reducing blood pressure.

In studies by Lewington,⁶ on a sample of more than 1 million adults, it was found that an increase, even very low, in blood pressure (2 mmHg) for the entire population would increase the risk of coronary mortality by 7% and the risk of stroke by 10%.

Current trends in dietary habits lead to the consumption of foods that increase blood pressure. The latest figures from the *Italian Atlas of Cardiovascular Diseases* show that, in Italy, 32% of the population is hypertensive and about 16% are at the limit of hypertension. As a result, it is necessary to implement actions and policies that can change the lifestyle and diet of the population.

The solutions for solving high pressure in the population may be different, i.e.:⁷

- The adoption of a diet that is low in sodium would produce a reduction in blood pressure of 2 to 8 mmHg, which would result, even at the minimum, in the risk of coronary mortality being lowered by 7% and the risk of stroke lowered by 10% from a reduction in blood pressure of 2 mmHg, which is also argued by Lewington;
- The adoption of a diet rich in vegetables would lead to a reduction in blood pressure between 8 and 14 mmHg;
- The reduction of body weight by 10 kg would reduce blood pressure by about 5 to 20 mmHg.

In Europe, the total economic impact of cardiovascular diseases in 2006 amounted to approximately €192 billion.⁸ In particular, costs for coronary heart disease amounted to €49 billion per year (about one fourth of the total) and the costs of stroke were €38 billion (about one fifth of the total).

The data presented by the studies cited would lead to the assumption that the mere adoption of a diet low in sodium (salt) could prevent a 7% increase in the risk of coronary mortality, equivalent to €3.4 billion per year in avoided costs in Europe, and a 10% reduction in the risk of stroke, which is equivalent to €3.8 billion per year in avoided costs in Europe. Reducing the amount of salt in the diet (one of the factors related to high blood pressure) would total, in benefits to Europe's health system, roughly €7.2 billion per year.

BY REDUCING THE SALT IN ONE'S DIET, A FACTOR LINKED TO HIGH BLOOD PRESSURE, THE BENEFITS FOR THE EUROPEAN HEALTH SYSTEMS WOULD BE APPROXIMATELY 7.2 BILLION EUROS A YEAR

6. CONCLUDING REMARKS

6.1 SOME CONSIDERATIONS

In light of the evidence and considerations that emerged from our work on nutrition and its link with health, it is possible to identify some fundamental and general recommendations.

Prevention is the key to ensuring a future with adequate conditions of health for younger generations

Over the last 50 years, there has been a growing awareness of the greater effectiveness and efficiency preventive interventions can have compared to corresponding actions for the benefit of those who are already ill. Prevention provides greater efficiency because it allows society to act for the benefit of a wider portion of the population compared to medical treatment; it is more efficient, because it has lower costs. Prevention is one of the main lines of action for the future because it is the best way to ensure the sustainability of health systems burdened by levels of investment and operating costs that are growing exponentially, as is the case with almost all the countries in the Western world. For these reasons, in recent decades there has been a gradual shift of focus from the medical treatment of diseases to their prevention. Nevertheless, not enough has been done, especially considering the dramatic change in eating habits worldwide.

The BCFN is convinced that prevention is an essential area – but not yet fully explored in all its potential – for the future of medicine and nutritional science, with the potential for far-reaching social benefits.

In particular, our work has clearly shown the central role of nutrition in either causing or preventing the occurrence of some of the most common and serious chronic diseases, at all stages of life. Prevention in this field is therefore essential and should be focused, especially, on younger generations: it is essential to define, develop and put into practice the systematic and widespread promotion of good dietary habits and lifestyles aimed at those who are at the beginning of their lives, for reasons of promoting better public health, as well as for ethical and moral reasons.

Therefore, prevention should be a priority for the long-term to ensure that the future generations will not find themselves in a situation of having worse health and well-being (even radically) than those experienced by previous generations.

Behavior is at the core of any intervention aimed at correcting current trends

During these two years of work, we have realized that there is growing awareness at all levels of the overall importance of the eating habits and lifestyles adopted by people – especially

in their early years – aimed at maintaining good health throughout the course of their lives. Food habits, in particular, are one of those most closely related to quality of life and people's health and, therefore, one of the most promising in terms of achievable results. As noted above, eating habits play a central role in the prevention of obesity and overweight conditions (now considered two of the most critical factors for health), for each of the major groups of non-communicable diseases (cancer, cardiovascular diseases, diabetes and metabolic syndrome), as well as neurodegenerative diseases and osteoporosis.

However, in order to establish the correct ways for improving the average health of the population, it is not sufficient (and will be increasingly less so) to focus on analysis, indications and actions simply on the “diet” adopted by people. What has clearly emerged from our work on these issues is that this is only a part, albeit significant, of the overall paradigm shift in diet and lifestyle needed to avoid making current trends even more devastating.

In particular, there is an underlying problem related to the profound changes in the “way of life” of people on the whole. This is illustrated by the increase in the average amount of calories consumed, as well as the serious deterioration in the average quality of the food eaten, a significant reduction in time devoted to physical activity, and the loss of the value attributed to food as a central element of everyday life from a social and cultural point of view.

The changing trends need to go in the direction of the rediscovery and re-actualization of an idea of nutrition and lifestyle that are associated with the key concept of “quality:” a reduction of the amount of food that is consumed in favor of a greater attention to its quality, but also the quality of living standards (with significant time devoted to physical activity and a reduction of tension and stress that now accompany contemporary daily life at all ages, starting from infancy) and the quality of the dialectical relationship between humans and food (with the rediscovery and promotion of the social and cultural values of the act of eating).¹

Obviously, this requires a total paradigm shift from our current thinking that has the person and their behavior at its center, and is not just strictly concerned with food choices.

The first, and perhaps most important, step in changing overall lifestyles that has emerged in recent decades is the correction of dietary habits and lifestyle in younger individuals, starting from the pre-school age through adolescence. This phase of life is important for developing healthy eating habits and behavior for health in childhood and adolescence, as well as health and quality of life later on:

- A healthy diet and adopting appropriate lifestyles help children and adolescents to achieve correct development (physical and mental) and maintain good health;
- A process of growth and development that is linked to a healthy diet lays the foundation for the future maintenance of good health in later life;
- It is likely – although hard to prove scientifically – that there is a beneficial “memory effect” achieved by the acquisition of correct eating and lifestyle habits in childhood and youth that may facilitate their maintenance in adulthood.

Clearly, the establishment of good habits early in life does not, in and of itself, guarantee a “life insurance policy:” it is necessary that all the following behavior in adulthood and maturity remain consistent with the basic guidelines that the BCFN has identified and which have been summarized above.

There needs to be cooperation between different actors involved in various capacities in determining the health and welfare of the community: Reversing current trends will not result from the effort of a single, isolated change agent

If it is true that behavior and food choices and people's lives are central ways to get any positive change in the average level of health and well-being, it is equally true – a belief

THE DEFINITION, DEVELOPMENT AND PRACTICE OF SYSTEMATIC AND WIDESPREAD PROMOTION OF PROPER EATING HABITS AND LIFESTYLE IS ESSENTIAL TO THOSE WHO ARE AT THE BEGINNING OF THEIR LIVES, BOTH FOR REASONS OF PUBLIC HEALTH AND FOR REASONS OF AN ETHICAL-MORAL NATURE

THE FIRST AND PERHAPS MOST IMPORTANT STEP TOWARD AN OVERALL CHANGE IN LIFESTYLES THAT HAS EMERGED IN THE LAST TEN YEARS, CONSISTS OF A CORRECTION OF THE EATING AND LIFESTYLE HABITS IN YOUNGER INDIVIDUALS, STARTING FROM PRE-SCHOOL AGE UP TO ADOLESCENCE

THE BEST GUARANTEE OF A CORRECT WAY OF EATING FOR CHILDREN AND ADOLESCENTS SEEMS NECESSARILY TO COME THROUGH A COLLECTIVE EFFORT, THE RESULT OF THE CONTRIBUTIONS BY MANY SUBJECTS: SCHOOL, FAMILY, PEDIATRICIANS, SPORTS ASSOCIATIONS AND MANUFACTURERS

that the BCFN has matured in its recent years of work – that the individual alone cannot change the trends that have been influenced, favored or not adequately discouraged by many relevant actors in health and public welfare, including healthcare institutions, doctors, the media and private companies.

Every effort to improve the current scenario will need to come through a full and synergistic involvement – with diverse and specific responsibilities and opportunities – of all of these five key players:

- People (as both individuals and as families);
- Institutions (both public and private, including medical-scientific groups and those that are closer to the social-cultural aspect of people's lives, such as schools);
- Doctors (especially pediatricians and family physicians, for their direct and more frequent contact with patients);
- Media (both specialized and, especially, mass media, which is able to influence public opinion and the collective consciousness);
- Private enterprise (starting with those companies that are active in the agro-food sector).

In particular, highlighting the synergies between these key players is not only important, but essential, when it focuses attention on initiatives helping prevention in childhood and adolescence.

Guaranteeing a better way of eating for children and adolescents will need to be a collective effort, the result of the contribution of many players (school, family, pediatricians, sports clubs, etc.) that care for the child at different times of day. Today, actions are often poorly coordinated or are carried out according to contradictory logic and objectives.

Consistent with these recommendations, the BCFN has emphatically stressed that the family and school, for different reasons, appear to be the main actors of the effective work of education concerning proper nutrition, addressed to the young because they are tomorrow's adults. On the one hand, it is in the family that the child learns to eat food and internalize behavior that he/she will naturally adopt, while on the other hand, the school – by virtue of the increasing importance of its presence with regard to food and its potential involvement with families – can and should play a truly active role in encouraging balanced eating habits, inviting families to understand what the most appropriate food choices are and becoming an ally with parents as part of a unified proposal for action.

In addition to the institutions, individuals/families and the media (a thorough and thoughtful analysis of the media's role is needed, but has not fallen within the key aims of our work, so far) are key players for instilling a virtuous path and way of life that was, in the past, only represented by the doctors. In fact, it is essential – especially in the future – that the role of family physicians and pediatricians fully becomes, even more than now, the first gateway of access to information about proper nutrition and adequate physical activity for all family members in their different stages of life (children, adolescents, adults, the elderly). For this purpose, it is useful for these professionals to have the best training to perform this role, both through the enhanced development and dissemination of specific education on these issues within university courses and through updating their knowledge and training in their profession.

Alongside the four main actors that make up the core of the information that is available about food choices and prevention work, a fifth one has emerged – the food industry. Food companies can actively contribute to the implementation of proposals and offers consistent with the directions on correct eating habits and lifestyles and actively promote their adoption. The role of the agro-food industry is especially important with regard to the following:

- The promotion of healthy dietary habits and lifestyles from the earliest years of life, through the definition and implementation of productive strategies (reformulation of existing products and/or products designed with improved nutritional content)

and communication and consumer education that is more in line with the findings from the most reliable scientific studies on the relationship between diet, lifestyle and health. These initiatives should be able to respond appropriately to the diverse needs of people who, because of time and time, cannot always easily eat properly;

- The improvement of scientific knowledge by promoting investments in applied research and the creation of joint university-industry groups that may help bridge the gap in current knowledge about the relationship between diet and health, especially in relation to childhood and adolescence;
- The improvement of communication processes between diet, lifestyle and health (with a particular focus on youth), by simply and transparently raising awareness about the nutritional values of different foods and the rules of good nutrition through various channels of communication available (Internet, advertising, packaging, etc.).

The role of the agro-food industry is important for every age group to establish a positive relationship between diet and health; and this is especially important for growing young people.

Childhood is characterized by a real difficulty in understanding by the child of the surrounding phenomena and the role played by food, which is mediated and interpreted entirely by parents. During the period of adolescence, however, there is the gradual loosening of ties with family practices learned early in life and the emergence of significant influences in the life of the individual (both medical and social) that appear can deeply influence lifestyles and diet.

In this context, it is clear that the food industry is one of the central players providing information and prevention aimed at children and adolescents that can be broad, integrated and effective.

The food industry appears to have, according to the BCFN, a primary role in providing appropriate responses for people's different lifestyles, both through product offerings that are appropriately profiled and through coherent and responsible communication

The speed and depth of current trends make the “time” variable central to any corrective action: Time is running out and the time is now

All data on health – even in geographic areas (such as Italy) normally considered the home of correct dietary choices and a healthy lifestyle – show a rapid, inexorable deterioration of average health conditions, at present and in the future. If current global food trends and lifestyles are not reversed, future generations will be condemned to health and well-being that is worse than that experienced by previous generations.

Some of the most important studies worldwide have shown that about 80% of cases associated with chronic non-communicable diseases could have been prevented by eliminating certain risk factors linked to lifestyle and diet without adequate prevention; it is estimated that this burden on global health could increase by 17% over just the next 10 years. And for the following decades, it will be impossible to expect any improvement, without drastic corrective measures. In few other cases in modern history has there ever been such a marked decline in the quality of life and health that will occur, according to the data, over the next 10 to 30 years, when today's children and adolescents will have reached adulthood or become adults. If we don't start – right now – to change the dietary habits and lifestyle of the present generations, starting from the very young, what will we do when all the health and medical problems associated with poor diet and unhealthy lifestyles fully unfold their potential adverse effects? This means that there must be defined and shared initiatives that – directed at sustainable well-being over the medium- and long-term – are also able to combine immediate and decisive results in the near future (measured from the perspective of a limited number of years). We need concrete actions to be implemented immediately.

THE ROLE OF THE AGRI-FOOD INDUSTRY IS IMPORTANT ESPECIALLY CONCERNING: THE PROMOTION OF HEALTHY EATING HABITS AND LIFESTYLES, THE IMPROVEMENT OF AVAILABLE SCIENTIFIC KNOWLEDGE AND IMPROVEMENT OF COMMUNICATION PROCESSES

IF WE DON'T BEGIN – RIGHT NOW – TO CHANGE THE EATING HABITS AND LIFESTYLE OF THE PRESENT GENERATIONS, STARTING FROM CHILDHOOD, WHAT WILL WE BE ABLE TO DO WHEN ALL THE HEALTH AND MEDICAL PHENOMENA ASSOCIATED WITH THEM DEVELOP THEIR FULL POTENTIAL OF ADVERSE EFFECTS?

6.2 GUIDELINES FOR THE FUTURE

In light of the analysis and discussions, what sorts of interventions and/or actions can and must be implemented to mitigate and reverse the negative trends taking place in the nutritional conditions and world health for improving the prospects of well-being, especially of future generations?

Promoting further study of the available scientific knowledge on the relationship between diet and health

Despite the significance of this issue, the first observational studies about the relationship between individual/collective behavior and the onset of the most common chronic non-communicable diseases began to develop only during the second half of the last century. The wealth of scientific knowledge today for nutrition is certainly more extensive and is growing constantly, but there is, however, a real opportunity to further improve our level of understanding the dynamics of diet-health.

We should focus on areas of “frontier” research which we believe are particularly promising and therefore, we can:

- Do more research on the mechanisms of aging and cell repair. We know that the incidence of non-communicable diseases is related to the health status (degree of inflammation) of some cells. The study of pro-inflammatory and inflammatory states, for example, could be one of the most promising fields of research, given its multiple relationships with the diseases under consideration, especially diabetes;
- Study gene-nutrient-disease relationships in more detail to deliberately and systematically understand the mechanisms of interaction between different nutrients and different genes, which in turn can play important roles in the prevention or in the cause of various diseases;
- Develop methodologies suitable for the early identification of diseases in individuals who exhibit some of the risk factors typical for the onset of diseases (cardiovascular, cancer or diabetes) – these subjects are the most relevant and useful for analysis and identification of the main relationships between diet and health;
- Systematically promote research on the topic of caloric restriction, to more fully understand the real needs of the body for food;
- Promote research approaches that are increasingly integrated and interdisciplinary among the various organizations, institutes, universities and other groups who study nutrition issues.

Furthermore, most studies on the relationship between nutrition and health have concerned the adult world: methodological, economic and organizational problems have made it difficult to extend the survey, in sufficient detail, to children and adolescents. In fact, the

nutritional problems related to growth – despite the enormous importance prevention has for children and adolescents – are an area that has still not been sufficiently investigated. Regarding research on the relationship between nutrition and health in the early stages of life, it particularly seems useful to do the following:

- Investigate the metabolic and endocrine disorders that follow the consumption of food and meals of different composition. The anatomical and functional consequences of different metabolic conditions that develop in the postprandial phase are very important in the development of chronic degenerative diseases and the relevant available data relating to children is, thus far, very limited;
- Investigate the actions for the short, medium and long term effects of environmental pollutants on metabolism, immunity and the neuroendocrine system. It is more and more alarming because of the impact of harmful substances in the environment, and also conveyed via food, on the metabolic balance of children and young people;
- Investigate the association between specific nutritional factors, meal composition, and diet, distribution of nutrients within the 24 hours after food is eaten, levels of motor activity, and growth and the onset of major chronic diseases;
- Investigate the role of exercise in regulating the intake quantity/quality of children’s food;
- Investigate the relationships between particular gene structures (polymorphism), nutritional habits, postprandial metabolic responses and metabolic disease in children.

From an operational standpoint, the BCFN has become convinced that, for Italy, the best way to provide a real and positive boost to research on nutrition and health would be through the creation of a “national research network,” made up of the best universities and other centers of excellence (public and private, national, and others), who are able to ensure the proper focus, rationalization and optimization of research funds, and above all, a precise definition of strategic research.

This network should have two purposes: one devoted to basic research to acquire knowledge that allows for better “food-individual” interaction; and the other focused on applied research with significant interaction from and guidance by the food industry.

This should provide the possibility of creating mixed research groups made up of universities and businesses, which will be much more effective and efficient. These groups can propose projects funded by the European Community within the framework of various programs, and the possibility of realizing a higher number of spin-off companies of specialized research, which can obtain rapid and significant results for the industry and help develop the growth of talented researchers who can bring their ideas and insights to fruition, as part of the cross-contamination that is needed between industry and research centers.

Given the importance of the food industry in the economy, all the conditions exist that are necessary for launching a big “countrywide project” on nutrition and health, capable of combining scientific research, technological development and economic growth. The BCFN is convinced that Italy, in fact, is the ideal candidate to become the country of global reference in this sector.

Promote the spreading of correct information and nutrition education, so as to promote the adoption of appropriate eating habits and lifestyle

As noted previously, through the work conducted over the past two years, we have seen that there is a high degree of convergence in terms of operational guidelines for an adequate diet which can prevent all major chronic diseases, regardless of the pathology under examination. In other words, there are lifestyles and diets capable of, simultaneously and in paral-

GIVEN THE IMPORTANCE OF THE AGRI-FOOD INDUSTRY IN OUR ECONOMY, ALL THE CONDITIONS EXIST FOR LAUNCHING A BIG “NATIONWIDE PROJECT” ON NUTRITION AND HEALTH, COMBINING SCIENTIFIC RESEARCH, TECHNOLOGICAL DEVELOPMENT AND ECONOMIC GROWTH

IT IS NECESSARY TO HELP PEOPLE CHOOSE AND IMPLEMENT A PROPER WAY OF EATING: WE NEED A STRONG COMMUNICATION EFFORT ON THE PART OF GOVERNMENTS, SCIENTIFIC SOCIETIES, THE MEDICAL PROFESSION AND PRIVATE ENTERPRISES, SO THAT INDIVIDUALS CAN ACQUIRE A GREATER AWARENESS OF THE IMPORTANCE OF EATING HABITS

lel, minimizing the risk of cancer, cardiovascular disease, and diabetes, as well as disorders such as overweight conditions and obesity.²

This is a very significant result because it lays the foundations for clear, unequivocal and timely messages about preferable lifestyles and food choices that can be communicated to citizens.

Therefore, a strong communication effort on the part of governments, scientific societies, the medical profession and private companies is needed to give people a greater awareness of the importance of dietary habits and a greater knowledge about the topic.

It is necessary to help people choose and implement a proper way of eating. What we know today in the field of diet is already enough to give rise to a massive, pervasive and scientifically robust communications campaign on a global scale, able to help us save a significant number of lives and greatly improve the quality of life on the planet.

In particular, it appears necessary to further promote the importance of the role of nutrition in the early stages of growth with all health care providers and families by encouraging them to actively control eating behavior (e.g., through the dissemination of regularly monitoring the body mass index). In this context, pediatricians play a decisive role because they have the potential for more intense and frequent contact with the families than the family doctors who, however, will care for adolescent patients later on.

Integrating nutrition into school curriculums will also be very important: such an initiative, in perspective, is simple but can have huge potential. The culture of prevention and a healthy diet cannot just be handed down from generation to generation, but also must be taught starting with primary school. This is a basic, civic element for people's health which helps to strengthen the culture of prevention. To this end, the BCFN considers the creation of multi-disciplinary training programs for the study of nutrition and its impact on human health in relation to food, nutrition, prevention and the Mediterranean diet to be very useful.

Alongside these initiatives, there is also a need for the food industry to be active and consistent in promoting communication standards aligned with the guidelines for a healthy diet.

[Structure policies and social-health interventions to effectively promote the spreading of healthy eating behavior, also looking to the international best practices in this area](#)

We have to rethink the way in which available scientific knowledge in the field of nutrition and health can be translated into concrete action, toward broad, comprehensive planning that can have a real impact on people's behavior.

The public institutions most involved in these issues are not the only ones called on to participate in the definition and implementation of such projects, but other parties, including private companies and doctors, will also need to play a proactive role (according to their specific areas of expertise).

The work done by the BCFN over the past two years has led to establishing some guidelines for improving all of the measures for the actual spread of healthier eating habits and lifestyles. A brief summary of these guidelines is below:

- It is essential that the dietary and lifestyle recommendations provided be practical and workable: in fact, they must be understandable and adoptable by families and individuals for the concrete circumstances of their lives. All too often, the instructions are correct, but difficult to implement, or are contradicted by practices and habits, even institutionalized, which are very far from the optimal principles. For example, con-

sider the widespread use in hospitals and schools of vending machines containing only snacks/candy/pastries/soft drinks, instead of fruit, which would be desirable on the basis of information provided by these medical facilities and institutions that manage these places of public interest;

- Intervention plans formulated for nutrition and health should be defined in structural terms that aim to influence behavior in a sustainable manner over time: from this point of view, the time horizon cannot be limited to the short term, despite the need for practical improvements to be found within a reasonable length of time. If, as it has become clear, it is necessary to fundamentally alter the trends observed in today's lifestyles, this will require programs that are consistent with each other and supported by adequate financial resources, with the awareness that such investments, over time, are also capable of ensuring substantial economic returns. Interventions too focused on achieving temporary and limited improvements and that do not have an adequate critical mass, will likely be unable to permanently affect the eating habits of families;
- In general, it is desirable that interventions on diet and health have a national (at least) breadth, with necessary local variations, which may differ in the form of their execution, but do not differ in substance from the guidelines and principles defined at the national (or international) level;
- For children and adolescents, it is necessary that the issues related to diet and lifestyle be addressed with an approach that combines information and experience ("active education"). Experimentation is certainly the most effective way when the subjects are children. The way to a healthy diet is also a step on the path to a broader education that helps create awareness through the formation of a taste capable of appreciating food that is "difficult," but excellent for health (such as, for example, fruits and vegetables). The introduction of these foods according to a proper practical approach thus becomes crucial for the definition of perceptions and beliefs that can be maintained even through adulthood;
- It is necessary to involve the medical profession in the process of spreading healthy eating habits. The family doctor and the pediatrician, in particular, could be a great "conveyor belt" of more correct dietary habits. This would require a significant investment and a greater awareness – at all levels – of the importance of the topic;
- It is necessary to ask the agri-food industry to think about implementing strategies and operational plans consistent with the guidelines identified for proper nutrition. This can help encourage them to conduct scientific, nutritional and technological research and to work constructively on several important topics that concern them (for example, the progressive improvement of the nutritional profiles, the definition of food with specific features, the improvement of the nutritional density of the products, etc.).

The issue of establishing appropriate policies to promote better conditions of diet, health and quality of life cannot ignore the need to identify actions, in addition to the above-mentioned, that are able to promote the necessity to "rebalance" food choices between the global North and the South, in order to overcome the strong contradictions that still exist.

IT IS INDISPENSABLE THAT THE DIETARY AND LIFESTYLE RECOMMENDATIONS PROVIDED BE PRACTICAL AND WORKABLE

OUR KNOWLEDGE AT
EVERYONE'S SERVICE



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Illustration of the model that relates nutritional balance with the protection and preservation of the environment



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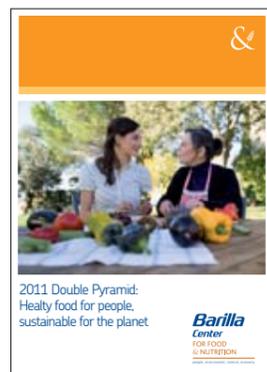
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