

SPECIAL ARTICLE

Nutrition, cardiovascular disease risk and climate change

Nutrición, riesgo de enfermedad cardiovascular y cambio climático

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Nutrition is an increasingly mainstream topic in the media. The vast majority of the media include articles on recipes and dietary recommendations that respond to society's growing interest in nutrition. Miracle diets and foods are proposed and false illusions are created about the therapeutic or preventive properties of certain foods. Moreover, climate change, which is becoming more and more pressing, has led to an interest in food that is not only healthy for people but also for the planet, i.e., sustainable and healthy food.¹ In 2015, the world leaders of the United Nations adopted a number of objectives (Sustainable Development Goals of the 2030 Agenda)² including Health and Wellness (goal 3), Responsible Production and Consumption (goal 12), and Climate Action (goal 13).

It is therefore becoming increasingly necessary that dietary recommendations be rigorous and grounded in solid scientific evidence that takes the health of the population into account while also considering the health of the planet (Fig. 1).

The "Health effects of dietary risks in 195 countries, 1990–2017"³ (GBD, 2019), recently published in the *Lancet*, is arguably the largest international collaborative study that



Figure 1 Fruits and vegetables.

reveals the enormous effect of diet on our health, and, in particular, on cardiovascular disease (CVD). This study examines the effect of 15 foods and nutrients on chronic disease mortality in people aged 25 years and older in 195 countries in different geographic areas of Asia, Europe, Africa, and the Caribbean. Overall, in 2017, dietary factors were responsible for 11 million deaths (22% of the total), meaning that almost one out of every four deaths worldwide is attributable to a dietary cause. CVD was the leading food-related cause of mortality, with 10 million deaths, followed by cancer, with 913,090 deaths, and type II diabetes with 338,714 deaths.

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Analysis of the effect of each of the 15 foods found that high *sodium* intake was the number one cause, with 3 million deaths, followed by low intake of *whole grains*, with 3 million deaths, and low intake of *fruit*, with 2 million deaths. This study also proved that the damage is even greater in lower-income populations.

One of the largest systematic meta-analyses carried out⁴ comprising 95 cohorts from different countries around the world demonstrated that for every 200 g/day of *fruit* and *vegetable* consumed, the risk of coronary heart disease fell by 8% and the risk of stroke by 16%, with a dose-response effect being achieved up to 800 g/day of consumption; no additional benefit was detected after this point.

Another recent meta-analysis of 45 cohort studies⁵ reported that for every 90 g/day of *whole grains* consumption, the incidence of coronary heart disease declined by 16% and the incidence of stroke by 16%.

The PREDIMED⁶ study, a randomised controlled intervention trial conducted in Spain and published in one of the world's leading medical journals, included 7747 middle-aged participants or older who had CVD risk factors. This study successfully demonstrated that a *Mediterranean diet* (MD) intervention supplemented with *olive oil* or *walnuts* was associated with a 30% lower cardiovascular risk than a control diet in which a reduction in fat intake was recommended.

There are data in Spain that indicate an increasing adoption of a *vegetarian diet* (which is relatively similar to the MD) and *vegan diet*, notably among young people. The most recent meta-analysis of 10 prospective cohort studies⁷ revealed that vegetarians have a 25% lower risk of incidence or mortality from acute myocardial infarction (AMI).

The consumption of *red meat* and *processed meat* ("cured meats"), on the other hand, increases the risk of CVD. In the EPIC cohort in Europe,⁸ with more than 400,000 participants from 9 countries and more than 7000 incident or deceased AMI cases, a 19% increased risk was observed for every 100 g/day of consumption of these foods. Red meat and processed meat consumption was positively associated with low-density lipoprotein cholesterol concentrations and systolic blood pressure, which could mediate this observed effect. Substitution of 100 cal/day of red and processed meat for 100 cal/day of fatty fish, yoghurt, cheese, or eggs was associated with a 20% decrease in the risk of AMI.

There is a wealth of other scientific evidence with respect to the effect of processed meat consumption and the increased risk of CVD, involving saturated fat and salt, both of which are cardiovascular risk factors. A review and meta-analysis of 17 cohort studies⁹ concluded that for every 50 g/day of cured meat consumption, there was a 42% increase in the risk of coronary heart disease. Another meta-analysis of 6 US cohort studies¹⁰ also found an increased risk of coronary heart disease associated with high red meat consumption.

The concept that moderate alcohol consumption was beneficial in reducing the risk of CVD has long been widespread. However, the largest study undertaken in 19 upper-middle-income countries,¹¹ with a pooled analysis of 83 prospective cohort studies, comprising 600,000 participants consuming alcohol at the time of the study, with more than 40,310 deaths and 39,018 incident cases of CVD events, has yielded results that contradict such a benefi-

cial effect. Alcohol consumption was positively associated with an increased risk of all-cause mortality, stroke, heart failure, fatal hypertension, fatal aortic aneurysm, and coronary heart disease, excluding AMI. Death exhibited a linear dose-response shape that, considering a reference category of 0–25 g/week of alcohol consumption, starts to rise starting at 100 g/week and displays a positive increase in mortality risk. The curve for all combined causes of CVD incidence exhibited a "J" shape, considering the same reference category; the lowest risk of incidence is observed for a threshold consumption of 100 g/week of alcohol, above which the risk increases.

As a result, the World Heart Federation has recently published a report (*Policy Brief*) on the impact of alcohol consumption on cardiovascular health,¹² which considers that the benefit of moderate alcohol consumption is a myth that should be dismissed as erroneous and that there is no safe level of consumption for cardiovascular health, or that at least the 100 g/week threshold for alcohol consumption is significantly lower than previously thought.

In the EPIC cohort in Spain,¹³ with 40,000 participants from five autonomous communities, our group has revealed that 40% of the greenhouse gases (GHGs) causing climate change that originate in the production of the foods that comprise the diet stem from the consumption of red meat and 20% from the consumption of dairy products. In contrast, less than 15% of dietary GHGs come from the combined consumption of plant-based foods (vegetables, fruits, cereals, and pulses). We have also documented that individuals who eat a dietary pattern whose production generates a higher volume of GHGs have a 26% higher risk of acute myocardial infarction¹⁴ than those who eat a dietary pattern that generates the lowest volume of GHGs.

Three main greenhouse gases have been identified that cause the greenhouse effect: CO₂ (carbon dioxide), which originates from energy production and transport, CH₄ (methane), which is generated by enteric fermentation of ruminants (cattle and sheep) and manure fermentation, and NO₂ (nitrous oxide), which derives from transport, manure fermentation, purines, and nitrogen fertilisers.¹⁵ Some 30% are linked to agriculture and, to a greater extent, to livestock farming, hence the relevance of animal-based foodstuffs. It must also be remembered that a significant part of the CO₂ that comes from the burning of fossil fuels is captured by forests; consequently, tons of CO₂ are released into the atmosphere during deforestation (as is currently occurring in the Amazon and in many regions around the world) when forests are cleared for use in agriculture and livestock farming.

Among many others,¹ this study clearly shows why a plant-based diet is healthy for people and for the health of the planet, and why a diet that is sustainable for the planet is healthy for humans.

A recent article published in the journal *Science*¹⁶ stated that in order to achieve the Paris Accord goal of a temperature increase of no more than 1.5°C and if possible 2°C by 2050 compared to the pre-industrial era, it is not enough merely to replace fossil fuels with green energy, but we must also change our current dietary paradigm by decreasing animal-based foods and increasing plant-based foods.

Conflict of interests

The authors have no conflict of interests to declare.

Key points

- High intakes of vegetables, fruits, and whole grains, a Mediterranean diet rich in olive oil and nuts, and a vegetarian diet reduce the risk of cardiovascular disease (CVD).
- Consumption of excessive amounts of red meat, processed meats, and alcohol increase the risk of CVD.
- The production of foods that reduce the risk of CVD generates low levels of greenhouse gases and thus, helps to mitigate climate change.

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