



FRUIT AND VEGETABLE CONSUMPTION AND CARDIOVASCULAR DISEASES PREVENTION

Cardiovascular diseases are the leading cause of death worldwide. Cancer is continuing to develop, but better preventive measures could slow it down and save hundreds of thousands of lives each year, especially in developing and emerging countries. That is, in essence, the key messages of the two lengthy reports made public on March 4th, 2020 by the World Health Organization (WHO) and the International Agency for Research on Cancer.

This issue of *The Global Fruit & Veg Newsletter* is dedicated to the recent publications on the role that fruit and vegetables (F&V) can play in preventing cardiovascular diseases.

Toni Meier *et al.* studied the relationship between cardiovascular disease risk factors in 51 countries in the WHO European region from 1990 to 2016. The study showed that the number of deaths caused by cardiovascular diseases rose from 12.3 million in 1990 to more than 17.6 million in 2016. A healthy diet rich in F&V could prevent around one in five premature deaths. Compared to other behavioural risk

factors, a varied and balanced diet is potentially a key mechanism to prevent premature deaths.

Xiuting Mo *et al.*'s study aimed to estimate the reduction in the burden of cardiovascular diseases in various scenarios of increased F&V consumption in Japan by 2060. The study suggests that moderately consuming F&V could control a significant percentage of cardiovascular diseases.

Finally, a meta-analysis by Dagfinn Aune *et al.* provides a summary of the data available on the intake of plant-based foods and antioxidants and the risk of cardiovascular disease, cancer, type-2 diabetes and all-cause mortality. The results support recommendations aiming to increase consumption of plant-based foods, and suggest that the optimum intake to prevent chronic illnesses could be 800 g/day of F&V, 225 g/day of whole grains and 15 to 20 g/day of nuts

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Healthy diet: a lever to overcome the burden of cardiovascular diseases

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According to Global Burden of Diseases (GBD) study 2016, cardiovascular diseases (CVDs) are the leading cause of death worldwide¹. The World Health Organization (WHO) considers a suboptimal diet a major risk factor for developing CVDs, in addition to lifestyle factors such as physical inactivity, smoking and alcohol². Dietary risks were responsible of more than 9.1 million premature deaths from CVDs worldwide in 2016, which equals to 52% of all CVD-related deaths³. Thus, healthy dietary patterns might be an effective lever to overcome the burden of CVDs.

This study aims to highlight the relation between dietary risk factors and CVDs in 51 countries in the WHO European Region between 1990 and 2016. Data from the comparative risk assessment (CRA) framework of the GBD was used to quantify CVD deaths attributable to 12 dietary risk factors, grouped by age and sex.

Twelve dietary risk factors relevant to CVD development

Of the 15 dietary risk factors reported by the CRA framework of the GBD, 12 were relevant to CVD development (Table 1):

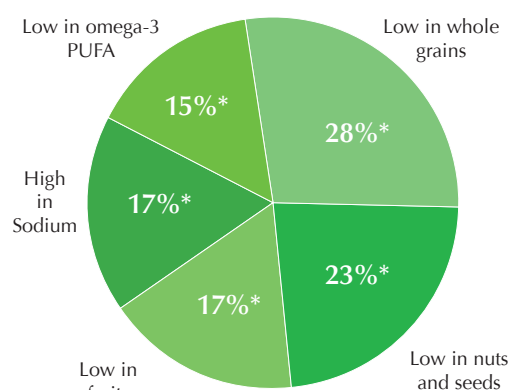
Table 1: Dietary risk factor and optimal level (theoretical minimum risk exposure level)

	Dietary risk factor	Theoretical Minimum Risk Exposure Level (TMREL)
A diet low in:	Fiber from all sources including fruits, vegetables, grains, legumes and pulses	19 to 28 g/day
	Fruits	200 to 300 g/day
	Vegetables	290 to 430 g/day
	Legumes	50 to 70 g/day
	Nuts and seeds	16 to 25 g/day
	Polyunsaturated fatty acids	9 to 13% of total daily energy
	Seafood omega-3 fatty acids (EPA, DHA)	200 to 300 mg/day
	Wholegrains	100 to 150 g/day
A diet high in:	Processed meat	0 to 4 g/day
	Sodium	1 to 5 g/day
	Sugar-sweetened beverages	0 to 5 g/day
	Trans fatty acids	0 to 1% of total daily energy

2.1 million deaths attributable to diet-related CVDs in 2016

In 2016, diet-related risks were associated with 2.1 million deaths from CVDs in the WHO European Region, representing 22.4 % of total deaths.

Dietary risk factors with the highest attributable fraction were a diet low in whole grains, in nuts and seeds, in fruits and in seafood omega-3 PUFA, and a diet high in sodium (Figure 1).



*% of total diet-related CVD burden

Figure 1: Dietary risk factors with the highest attributable fraction of total diet-related CVD burden

From 1990 to 2016, diet-related CVD deaths out of total mortality ranged in the 51 countries included in the study between 38.2 % in the Ukraine to 9.8 % in Israel.

Between 2010 and 2016, the absolute number of diet-related premature CVD deaths increased by 25,600 deaths (+4.5 %) in Western Europe and 4300 deaths (+1.9 %) in Central Asia. Moreover, in 32 countries, the absolute diet-related CVD mortality increased in adults younger than 70 years by 20,000 deaths in 2016 compared to 2010, leading to totally 601,000 deaths in this age group (28.6 % of all diet-related CVD deaths). However, the age-standardized death rates decreased in all considered subregions.

In conclusion, adopting a healthy diet that takes into account the twelve dietary risk factors cited previously could prevent approximately one in every five premature deaths. Compared to other behavioral modifiable risk factors such as physical inactivity, drug and alcohol abuse, tobacco smoking, etc., improving diet is the most effective means to prevent premature deaths from CVDs in the WHO European Region.

Based on: Meier T. et al. Cardiovascular mortality attributable to dietary risk factors in 51 countries in the WHO European Region from 1990 to 2016: a systematic analysis of the Global Burden of Disease Study. *Eur J Epidemiol.* 2019;34(1):37-55.

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Coronary heart disease and stroke burden attributable to fruit and vegetables intake in Japan

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Numerous studies have confirmed the association between fruit and vegetables (F&V) consumption and the risk of chronic diseases, particularly cardiovascular and cerebrovascular diseases (CVDs)^{1,2}. In Japan, CVDs are one of the most contributors to the disease burden. Also, CVD burden is expected to increase rapidly among the rapidly ageing population of Japan³.

In parallel, Japanese adults have a lower F&V intake than in other countries despite the national recommendation to consume daily at least 350 g of vegetables (i.e. 5 servings at 70 g per serving, potatoes and legumes excluded) and 200 g of fruit (i.e. 2 servings at 100 g per serving)⁴. According to the Japanese National Health and Nutrition Survey 2016, the daily consumption of F&V significantly decreased among adults over 20 years old, compared to 2006 (269.4 g of vegetables and 98.9 g of fruits in 2016 vs 300.5 g of vegetables and 107.5 g of fruit in 2006)⁵.

Five scenarios of increased intake of F&V to reduce CVD burden in Japan by 2060

The aim of this study is to estimate and project the reduction of CVD burden under different scenarios of increased intake of F&V in Japan by 2060.

Population attributable fractions (PAF) were calculated by gender and age in 2015. The projection of CVD burden reduction considered 5 scenarios for 2015, 2030, 2045 and 2060:

- Scenario 1: a baseline with no change in F&V intake;
- Scenario 2: a moderate increase of fruit intake (+50 g/day or ½ serving);
- Scenario 3: a high increase of fruit intake (+100 g/day or 1 serving);
- Scenario 4: a moderate increase of vegetables intake (+70 g/day or 1 serving);
- Scenario 5: a high increase of vegetables intake (+140 g/day or 2 servings).

For each scenario, potentially preventable disability-adjusted life years (DALYs) were estimated.

F&V intake at baseline in 2015

Fruit and vegetables consumption increased with age:

- 10.3 % at 20-29 years VS 32 % at 70+ years consuming more than the recommended daily amount of vegetables;
- 20.1 % at 20-29 years VS 39.1 % at 70+ years consuming more than the recommended daily amount of fruit.

For all age groups, men consumed more than the daily vegetables than women but less fruit:

- Vegetables intake: 292.7 g/day for men vs 279.3 g/day for women;
- Fruit intake: 99.3 g/day for men vs 121 g/day for women.

Projections of CVDs DALYs under different scenario by 2060

In 2015, approximately 302,055 (12.6 %) and 202,651 (8.5 %) of DALY from CVD were associated with an intake of F&V below the recommended daily amount.

- Under the scenario of a moderate increase of fruit and vegetables intake, the DALY from CVD decreased to 8.5 and 5.4% respectively.
- With the scenario of a high increase of fruit and vegetables intake, they decreased to 4.9 and 2.3 % respectively (Figure 1).

In 2060, the percentage of the CVD burden (DALY) due to insufficient intake of fruit and vegetables is estimated to decrease to:

- 7.9 and 5.4 % respectively under the moderate increase scenario,
- 4.5 and 2.4 % respectively under the high increase scenario (Figure 1).

These results demonstrate a probable reduction in the CVD burden even with a moderate improvement in F&V intake by adding up to ½ additional serving of fruit or 1 serving of vegetables. They are in accordance with previous meta-analysis showing that, by increasing F&V intake, there is a potentially great impact in reducing cardiovascular disease burden.

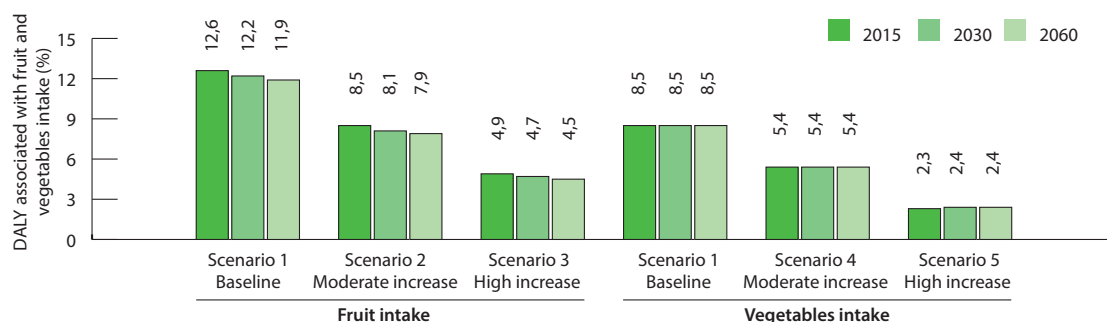


Figure 1: % DALY due to lower-than-recommended amount of F&V intake in 2015, 2030 and 2060

Based on: Mo X. et al. Coronary heart disease and stroke disease burden attributable to fruit and vegetable intake in Japan: projected DALYS to 2060. BMC Public Health. 2019; 19(1):707.

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Healthy diets rich in plant foods for prevention of chronic diseases

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For many years, epidemiological studies have demonstrated that a healthy diet rich in fruit and vegetables (F&V), legumes, whole grains and nuts is recommended for preventing chronic diseases such as cardiovascular diseases (CVDs), type 2 diabetes and several cancers¹⁻³.

This article focuses on recent studies on an intake of plant foods and the risk of CVD, cancer and all-cause and cause-specific mortality.

Intake of fruits, vegetables and nuts and the risk of coronary artery disease, stroke, CVD overall, total cancer, and all-cause mortality

• Fruit and vegetables (F&V)

In 2013, an estimated 5.6 and 7.8 million premature deaths may have been attributable globally to a F&V intake < 500g/d and < 800g/d respectively⁴.

In our previously published meta-analysis of 95 studies⁴, we observed an inverse association per 200 g/d of F&V intake (i.e 2.5 serving*) for stroke, all-cause mortality, coronary artery disease, CVDs, and total cancer (cf. Table 1). In non linear dose-response analyses, the association between total F&V intake and coronary artery disease or mortality from stroke were linear up to 800 g/d, whereas for the remaining outcomes the association were nonlinear. For stroke incidence and mortality combined, CVDs, and all-cause mortality the largest reductions were observed when increasing F&V intake from 0 to 400 g/d. Some additional reductions were observed up to 800 g/d, whereas for total cancer there was little further benefit beyond an intake of 600 g/d⁴.

At that time, only the European Prospective Investigation into Cancer and Nutrition (EPIC) study had analyzed other causes of death⁵, and found:

- Inverse associations between fruit intake and mortality from digestive diseases or unknown causes of death;
- Inverse associations between vegetable intake and mortality from circulatory diseases, respiratory diseases, digestive diseases and for other causes of death.

Other studies have published and show mainly an inverse association between F&V intake and CVDs.

With regard to specific cancers, the WCRF** Third Expert Report (published in 2018) considered that there is probable evidence that F&V consumption reduces the risk of aerodigestive cancers as a group. However, none of the individual cancer sites assessed had a judgment of probable or convincing any longer⁶. For several individual cancers, the evidence is now considered limited and suggestive of an association, or limited and no conclusion is possible.

Some studies show that an inverse association between F&V consumption and breast cancer risk has become apparent with longer follow-up^{7,8}.

• Nuts

In a meta-analysis of nut intake and various health outcomes, the

* One serving = 80 g ** World Cancer Research Fund

Based on: Aune D. Plant Foods, Antioxidant Biomarkers, and the Risk of Cardiovascular Disease, Cancer, and Mortality: A Review of the Evidence. *Adv Nutr.* 2019 Nov 1;10(Suppl_4):S404-S421.

summary RRs per 28 g/d increase in nut intake were as follows: for coronary artery disease; stroke, CVD, total cancer, all-cause mortality (cf. Table 1).

Table 1: Summary risk reduction (95% CI) from meta-analyses of intakes of F&V and nuts and coronary artery disease, stroke, CVD, cancer and all-cause mortality

	Summary risk reduction (RR) – 95% Confidence Interval	
	F&V intake (per 200 g/d) ⁴	Nut intake (per 28 g/d) ⁹
Coronary artery disease	0.92	0.71
Stroke	0.84	0.93
CVD	0.92	0.79
Total cancer	0.97	0.85
All-cause mortality	0.90	0.78

We estimated that approximately 4.4 million premature deaths might have been attributable to a nut intake <20 g/d globally (no data for Africa and the Middle East) in 2013⁹.

Nutrients from plant foods contribute to a lower risk of chronic disease

Nutrients from plant foods, such as fiber, vitamin C, carotenoids, antioxidants, potassium, magnesium, flavonoids, unsaturated fats and vegetable protein may act synergistically through several different mechanisms to reduce the risk of chronic diseases and mortality.

A high intake of dietary fiber, F&V, nuts, legumes, and whole grains has been found to reduce cholesterol concentrations, blood pressure, and inflammation, to improve vascular function, and to regulate the immune system. We have also found support for the findings on F&V and CVDs, cancer and mortality by analyzing data on biomarkers of F&V intake (vitamin C and carotenoids) measured in blood and risk of these outcomes and found more linear reductions in risk with the biomarkers of these nutrients¹⁰.

In addition, there is a growing body of evidence showing that high intake of F&V and specific types of fruits and vegetables reduces cardiovascular disease risk factors such as total cholesterol, LDL cholesterol, and systolic blood pressure and may improve endothelial function^{11,12}.

To conclude, recent studies show inverse association between intake of F&V, whole grains, and nuts and the risk of coronary artery disease, stroke, CVD overall, total cancer, and all-cause mortality. The strongest reductions in risk were observed at an intake of 800 g/d for F&V and 15–20 g/d for nuts. A healthy diet rich in plant foods could potentially prevent several million premature deaths each year if adopted globally.

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