Plant-based diets & CVD

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Cardiovascular disease (CVD), primarily ischaemic heart disease (IHD) and stroke, is the leading cause of global mortality and a significant cause of disability ([1]). However, healthy lifestyle choices may reduce the risk of CVD, with nutrition playing a pivotal role ([2]).

In parallel with an increased focus on climate change and carbon footprint, the interest in plant-based diets and their potential health effects has increased over the past decade. The term “plant-based diet” encompasses a wide variety of dietary patterns containing lower amounts of animal-source foods, such as dairy and meat, and higher quantities of plant-sourced foods. It can refer to diets such as vegetarian (excluding meat), vegan (excluding all animal products), and semi-vegetarian (mainly pant-sourced, but does include some meat products, fish, eggs, and dairy) ([3],[4]).

A healthy plant-based diet is low in cholesterol, fat, animal products, salt, and sugar ([5]), and growing research points to many health benefits, both in the prevention and treatment of diseases such as obesity, type 2 diabetes mellitus (T2DM), and other metabolic disorders ([6],[7],[8]).

There is mounting evidence that healthy plant-based diets benefit cardiovascular health ([9],[10],[11],[12]). Several systematic reviews and meta-analyses demonstrate that various plant-based diets can reduce CVD risk factors. These CVD risk factors include blood pressure ([13]), total cholesterol, low-density lipoprotein cholesterol (LDL-C) ([14],[15]), glycated haemoglobin (HbA1c) ([16],[17]) and body weight ([18]).

A recent systematic review and meta-analysis included 13 prospective cohorts (844,175 participants) and examined the associations between vegetarian and vegan diets and the risk of CVD, IHD and stroke ([19]). The meta-analysis showed a 15% reduction and a 21% reduction in the relative risk of CVD and IHD, respectively, for vegetarians compared to non-vegetarians. However, no clear association was observed for total stroke or subtypes of stroke.

Compared to non-vegetarians, vegans had an 18% reduction in the relative risk of IHD. No clear association was observed between vegan diets and CVD or stroke; however, the conclusions were limited by the small number of studies.

The current meta-analysis could not assess the association between the quality of vegetarian or vegan diets and CVD, IHD or stroke risk. However, the quality of the specific components of plant-based diets is essential. Several earlier studies indicate that not all plant-source foods have beneficial cardiovascular effects. In these studies, a healthy plant-based diet (characterised by a high intake of whole plant foods) was associated with a reduced CVD risk. In contrast, an unhealthy plant-based diet (characterised by a high intake of sugar-sweetened beverages, refined grains, potatoes/French fries, and other fast foods) was associated with increased CVD risk ([20],[21],[22]). Similar associations have been found for T2DM ([23]) and non-alcoholic fatty liver disease (NAFLD) ([24]), which are both implicated in CVD risk ([25]).

Mechanisms of action

Healthy plant-based diets are high in fibre, unsaturated fats, and polyphenols which may reduce CVD risk. These plant-based diets contribute to greater diversity in gut microbiota, which is associated with a lower risk of developing metabolic disorders and CVD ([26]).

The positive impact of healthy plant-based diets may be due to high amounts of fermentable fibres, polyphenols and polyunsaturated fatty acids. These constituents act as prebiotics and selectively stimulate the increase of beneficial species in the gut microbiota and the production of short-chain fatty acids (SCFAs), impacting immune, metabolic, and neuroendocrine function ([27]).

Healthy plant-based diets provide significant amounts of fibre, beta-glucans, and plant phytosterols that may improve cardiovascular health through their cholesterol-lowering effect. These effects are mediated by lowering cholesterol and fat absorption, altering cholesterol synthesis, increasing bile acid synthesis, and decreasing bile acid absorption ([28]).

The low saturated fat and high unsaturated fat contents (polyunsaturated fatty acids (PUFA) and monounsaturated fatty acids (MUFA)) of a healthy plant-based diet may lower CVD risk by improving the blood lipid profile and reducing inflammation. Saturated fatty acids interact with the gut microbiome to promote the translocation of lipopolysaccharide (LPS), a pro-inflammatory endotoxin, into the bloodstream whereas PUFAs activate anti-inflammatory pathways ([29],[30]). Replacing saturated fat with MUFAs and PUFAs may also improve insulin sensitivity and help reduce the risk of developing T2DM, which are considered risk factors for CVD ([31],[32]).

High-quality plant foods are rich in antioxidants linked to cardiovascular benefits, such as polyphenols, vitamins C and E and beta-carotene. The antioxidant capacity of polyphenols and their ability to modulate nitric oxide (NO) production helps to maintain endothelial function. Polyphenols may also improve cardiovascular health by inhibiting platelet aggregation, limiting LDL oxidation, and reducing vascular inflammation ([33],[34]).

Healthy plant food diets are also replete with minerals essential for cardiovascular health, such as magnesium and potassium. Magnesium has beneficial effects on glucose metabolism and insulin sensitivity. Magnesium also has a role in regulating vascular tone, atherogenesis and thrombosis,

and vascular calcification. It has anti-arrhythmic properties and, as such, has a significant influence on the pathogenesis of CVD ([35]). Potassium has beneficial effects on endothelial function and blood pressure ([36],[37]).

Replacing animal-based foods, especially red and processed meats, with healthy plant-based foods could also exert cardioprotective effects. Red meat and processed meat products contain high levels of saturated fat, cholesterol, haem iron, sodium, nitrates, and nitrites and contain precursors for toxic gut-derived metabolites such as trimethylamine-N-oxide (TMAO), all of which have been linked with CVD ([38],[39],[40],[41]).

Individuals may find it difficult to exclude all meat and/or animal products. However, a wide variety of plant-based diets can be tailored to individual preferences, and there is evidence that diets with lower amounts of animal products, mainly red and processed meat, such as the Mediterranean Diet, still confer benefits for CVD risk reduction ([42],[43],[44]).

While plant-based dietary patterns have been widely promoted for CVD risk reduction it is important to recognise the quality of plant food. Emphasis should be placed on high-quality plant foods (unprocessed) such as fruits, vegetables, whole grains, legumes, and nuts while limiting poor quality (highly processed) plant foods with low nutrient value and high saturated fat, sodium, and sugar content. It is also important to recognise that the nutrient composition of plant-based diets might not be replete, particularly B12 in vegan diets, and additional supplementation may be required ([45]).

Conclusion

The incidence and prevalence of CVD are increasing and present a significant public health challenge. The recent observational meta-analysis cannot infer a causal relationship between a vegetarian/vegan diet and CVD risk. However, it adds to the expanding body of research indicating that plant-based dietary patterns confer benefits to cardiovascular health. Therefore, dietary modifications in the form of a plant-based diet may be beneficial in preventing and managing CVD.

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