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The antihypertensive effect of plant foods

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EDITORIAL ARTICLE

THE ANTIHYPERTENSIVE EFFECT OF PLANT FOODS

Hypertension, the invisible health risk, according to WHO is a widespread health condition affecting over a billion people across the globe, with considerable burden on the healthcare system. Worryingly, 46% of adults with hypertension are unaware of it, while only 1 in 5 adults (21%) have it under control.[1] Traditionally, the main approach to managing hypertension has been a pharmacological intervention. However, in recent years, there has been a paradigm shift towards incorporating lifestyle modifications, with particular emphasis on dietary strategies, as part of a comprehensive approach to managing this condition.[2]

According to the National Health Institute, a public health strategy, which decreases the BP level in the general population by even slight amounts, has the potential to substantially reduce morbidity and mortality or at least delay the onset of hypertension. For example, it has been estimated that a 5 mmHg reduction of Systolic Blood Pressure (SBP) in the population would result in a 14 percent overall reduction in mortality due to stroke, a 9 percent reduction in mortality due to CHD, and a 7 percent decrease in all-cause mortality.[3] Therefore, there is a healthcare urgency in underlining the importance of applying healthy dietary patterns to patients, as part of the holistic management of this condition, which leads to a decrease of this magnitude.

The DASH dietary pattern, acronym of Dietary Approaches to Stop Hypertension, is a diet promoted by The United States Association's National Institute of Health's National Heart, Lung, and Blood Institute (NHBLI) to combat this silent killer. This food pattern emphasizes daily consumption of whole grains, fruits and vegetables, low fat dairy products, nuts, beans and seeds, lean meat, poultry and fish, meanwhile restricting intake of saturated and total fat. In the original DASH Diet Study, a significant reduction in systolic and diastolic blood pressure (DBP) by 11.4 and 5.5 mmHg, respectively, in patients following the DASH diet vs the control diet was found although sodium intake was held constant, more evident in the hypertensive subjects.[4]

In Europe, the recently revised recommendations of hypertension by the ESH 2023 guidelines, advise the adoption of plant-based healthy diets limiting the consumption of animal-based foods and emphasize the increased consumption of potassium, preferably via dietary modification, in alignment with the dietary recommendations for BP regulation from the AHA guidelines.[2,5]

The Mediterranean diet is based on the traditional dietary pattern of ancient Greece and southern Italy, which is rich in fruits, vegetables, legumes, cereals, dairy products (cheese, yogurt), fish, olive oil, and with a small amount of wine and lean meats. Although the main differences with the DASH diet are restricted in emphasizing the seasonality of fresh foods, the large number of foods containing polyphenols (especially olives and extra virgin olive oil) and the use of vegetable oils rather than animal oils, the antihypertensive impact of this diet seems less pronounced, although this might not be the case. Plenty of data from reviews and meta-analyses show that MD acts protectively reducing SBP and DBP by 1,39 to 2.35 mmHg and 1.53 to 1.58 mmHg, respectively, effect able to impact significantly on public health, while the odds of devel-

oping hypertension are 13% lower with higher rather than lower adherence to MD.[6,7] In the Hellenic National Nutrition and Health Survey (HNNHS), overweight and obese individuals with stricter adherence to the MD with a score > 23 had a 36% lower probability of developing hypertension, and when combined with body weight status, this probability increased to 60%.[8] Systematic reviews and meta-analyses of RCTs and observational studies show that vegetarian dietary patterns, including vegan diets and diets which incorporate specific animal products (eggs and dairy), show significant reducing action in SBP of 5-7 mmHg.[9,10]

The impact of fruits and vegetables on BP has been imprinted in several studies, indicating that increased consumption relates with a significant drop in BP. In a 6-month interventional trial, participants who were educated to increase their fruit and vegetable consumption had a 4 mm Hg average drop in their SBP when compared with the control group.[11] In the prospective Chicago Western Electric Study, it was shown that men who consumed 14-42 cups of vegetables and fruits per month (0.5-1.5 cup per day), in comparison with lower consumers, showed significantly lower increase in SBP per year for the next seven years (-2.8 mmHg and -2.2 mm Hg totally), with a concomitantly significant reduction in the increase of the DBP.12

Nut consumption is known to reduce blood cholesterol and is associated with reduced cardiovascular disease, but effects on BP are inconsistent. Findings from the Walnuts and Healthy Aging Study, where the intervention group consumed 15% of the energy needs as walnuts for 2 years, indicated that walnut consumption reduces mean office SBP in elderly −4.6 mm Hg (95% CI, −7.4 to −1.8 mm Hg) in the walnut group vs −0.6 mm Hg (95% CI, −3.4 to 2.2 mm Hg) in the control group, especially in those with mild hypertension, reducing also the need for antihypertensive medication.[13]

Dietary fiber, in which food with complex carbohydrates are rich in, constitutes an ingredient which seems to have a considerable antihypertensive effect, lowering both SBP and DBP at a magnitude of -1.13 to -1.56 mmHg and -0.39 to -1.65, respectively, more profoundly in hypertensive subjects. So, the increased consumption of dietary fiber, contributes to the prevention and treatment of hypertension, which seems so important for cardiovascular health.[14,15,16]

Nitric oxide (NO) is an omnipresent molecule, proposing its important role in health maintenance. It is a potent vasodilator and relaxant of the vascular endothelium, and a decrease in the availability and/or bioactivity of NO is associated with the development of hypertension, endothelial dysfunction, atherosclerosis, and CAD. NO, is mainly endogenously produced by the amino acid L-arginine, with the presence of oxygen and the NO synthase enzymes, however, the diet can provide an alternative source, contributing significantly to the availability of NO in the human body via the nitrate-nitric-NO pathway. Dietary patterns rich in nitrates like the Mediterranean, the DASH diet and other plant-based diets, contribute to the higher production of NO in our organisms in comparison with the Western dietary pattern, exerting their favorable effects in the cardiovascular system. The main dietary sources of inorganic nitrates, precursors of NO, are the green leafy vegetables, among which the beetroot holds the lead. Meta-analyses of inorganic nitrate in CVD risk factors, have shown that its consumption- mainly from beetroot juice- can decrease SBP and DBP significantly in short-term[17,18] and lower the risk of hypertension incident after 3 years of consuming a diet rich in nitrate-containing vegetables in the Tehran and Lipid Glucose Study.[19] The aforementioned plant-based diets have significant potential to enhance NO bioavaila-

bility because they contain variety of foods rich in l-arginine and nitrates—the two key substrates for endogenous and exogenous NO production, respectively. In addition, these dietary patterns are rich in vitamin C, polyphenols, and marine long-chain ω3 fatty acids, which may enhance NO production and reduce NO degradation in the body.[20]

WHO recommends increasing dietary potassium intake to reduce BP and the risk of CVD, stroke, and coronary heart disease in adults (strong recommendation). It recommends a potassium intake of at least 3,510 mg/day for adults (under recommendation conditions).[21] A forest plot meta-analysis comparing BP levels in the K supplement group and the control group identified a mean difference of −3.9 (95% CI, −5.2 to −2.6) and −2.4 (95% CI, −3.8 to −1.1) mm Hg for SBP and DBP, respectively. A dose-response meta-analysis of RCTs on potassium intake and BP, showed that there exists a non-linear relationship between potassium intake and SBP and DBP. Greater reduction in BP was seen in patients with hypertension and individuals with higher levels of sodium intake receiving K supplementation. Increased BP with high potassium excretion was noted in participants with hypertension taking antihypertensive medications and in individuals with low to intermediate Na intake, indicating that these groups should avoid excess intake of potassium supplements.[22] Consequently, the sodium to potassium ratio may be more important than the specific amounts of sodium and potassium an individual consumes. The data support the view that an increase in the potassium to sodium ratio would reduce BP in the general population and would significantly reduce CV mortality. Compared to diets based on whole foods, diets based on processed foods are high in sodium and low in potassium.[23] Siani A et al showed that increasing dietary potassium intake from natural foods is a feasible and effective measure to reduce antihypertensive therapy, since 38% and 81% of the intervention group patients with hypertension after 1 year of following a high potassium diet stopped the treatment and reduced the treatment to less than 50% vs 9% and 29% in the control group of the customary diet, respectively.[24]

According to the position document of the ESH, there are specific dietary components, called nutraceuticals, the use of which in low-risk individuals with normal-to-high BP levels, could decrease BP. Beetroot juice has the most convincing evidence of antihypertensive effect. Antioxidant rich beverages (teas, coffee) could be considered. Among nutrients, magnesium, potassium and vitamin C supplements could also improve BP.[25]

It is, therefore, significant that healthcare professionals encourage their patients with pre-hypertension or hypertension to comply with the principles of a healthy diet which promotes the systematic consumption of whole plant-derived foods which through a variety of mechanisms act protectively and therapeutically against this health hazard.

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