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Beneficial effects of nonpharmacological interventions in the management of essential hypertension

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Abstract

Essential hypertension is a major health problem causing excess cardiovascular morbidity and mortality. Management of essential hypertension consists of pharmacological and nonpharmacological interventions. In order to prevent and/or treat hypertension, parameters like nutrition, body weight, and physical exercise should be evaluated and taken under consideration for improvement. A large body of evidence clearly support that the role of salt, alcohol, fruits, and vegetables is important for high blood pressure. Furthermore, maintaining a normal body weight should be succeeded along with physical activity few times per week if not daily. Nonpharmacological intervention is rather a dynamic procedure that takes a multilevel approach with repeated training of the hypertensives by a team of expert physicians, rather than a single based guidance. Additionally, it should be based on a profile customization and personalized approach. Intensive interventions aiming at lifestyle changes through educational meetings are considered more effective in lowering high blood pressure. This consists of a lifestyle modification with a permanent basis for patient's daily schedule and eventually should become a philosophy for a better quality of life through improvement of nutritional and exercise behavior. Further studies are needed so intervention guideline models can be even more effective for patients with essential hypertension.

Keywords

Essential hypertension, lifestyle interventions, nutrition, body weight, exercise

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Hypertension in the general population

Essential hypertension (EH) is the most common risk factor for cardiovascular diseases (CVD) and globally, the first cause of mortality. High blood pressure (BP) has been recognized as a primary cause for cerebrovascular (51%) and cardiovascular (45%) mortality.[1] The prevalence of hypertension in the general adult population varies between 30% and 45%.[2]

In the developed countries, hypertension has a higher prevalence and this has been linked to the modification of the daily condition of a stressful life. Alterations in eating behavior, low levels of physical activity, excessive body weight, smoking and alcohol consumption, play a vital role for developing hypertension.[3] Furthermore, reduced physical activity and sedentary occupation that derive from limited everyday free time, automation and the absence of weekly exercise philosophy are additional risk factors for high BP. Tobacco and alcohol use on the other hand, promote hypertension and the rates of smoking and alcohol consumption are widespread in the developed world, which is worthy of consideration.

EH management

Dealing with EH requires two basic actions: prevention and treatment. Prevention strategies in the general nonhypertensive population take into account education, training, and informing people on how to improve their lifestyle habits, in order to minimize the potential for developing hypertension. Secondly, in the presence

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of hypertension, management is based on two major factors: pharmacological and nonpharmacological interventions to benefit against high BP, depending on the classification of BP levels.

In the hypertensive population, nonpharmacological interventions can be applied either as an initial treatment before drug therapy or in combination after. In hypertensives on pharmacological treatment, lifestyle changes that can be adopted permanently may reduce the use of antihypertensive medication. However, is it achievable?

Nonpharmacological interventions

Daily habits consist of a lifestyle profile affected by a number of factors. Among these, it has been stated that nutrition, exercise, and body weight are the major ones able to decrease BP levels.[4] Modification of the above parameters is targeted in terms of quality and quantity criteria, in order to balance their beneficial effects. In particular, lifestyle interventions were studied in a previous meta-analysis, where reduction in BP levels was recorded: for improved diet 5.0 mmHg of systolic blood pressure (SBP) reduction and 3.7 mmHg of diastolic blood pressure (DBP) reduction and for exercise 4.6 mmHg of SBP and 2.4 mmHg of DBP.[5] Similar data were obtained in a recent meta-analysis, as alterations in SBP, after nonpharmacological interventions in a total of 6779 hypertensives, were: for behavioral counseling −5.4 mmHg, for dietary modification −3.5 mmHg, for physical activity −11.4 mmHg, and for multiple interventions −6.0 mmHg.[6] In addition, intense education training for hypertensive patients has more beneficial effects in controlling BP when compared with those that had a basic guideline support, as shown in the VALNORM study.[7] Other lifestyle factors, medical and physical exams, environment, and anxiety levels might also affect outcomes.

Dietary patterns against EH

Nutrition habits affect BP levels

Relationship of nutrition profile and CVD through elevated BP has been widely studied and dietary habits have been linked to BP levels. Results from the EPIC study showed that for 7061 nonhypertensive women (35–64 years), the body weight, waist circumference, body mass index, processed meat, and wine and potatoes consumption correlated directly with BP values; while increased eating of certain foods was inversely associated with SBP (vegetables, yoghurt, eggs) and DBP levels (oil).[8] Recent data from the analysis of the NutriNet-Santé Study, support the same profile relationship between nutrition and BP levels in 8670 healthy volunteers. Direct association was found between BP and alcohol intake for both gender, and salt only for men. Similarly, a negative association between BP levels and consumption of fruits and vegetables was reported.[9]

Dash diet profile

The Dietary Approaches to Stop Hypertension (DASH) was designed to assess the relationship of hypertension and nutrition profile. The effects of modifying nutrition patterns have been investigated in several studies that tested either the original DASH diet or nutrition parameters. The data led to new nutrition guidelines for US people. The DASH diet that includes low fat dairy products and a high intake of fruit, vegetables, and fiber provides important insights for public health strategy.[10] It is likely, that several aspects of the DASH diet, rather than just one nutrient or food, reduces BP levels.

In a subgroup analysis, the DASH diet lowered BP in all subgroups (male, female, African Americans, non-African Americans, hypertensive and nonhypertensive individuals).[11] It resulted in a significantly greater decrease of BP levels in African Americans (SBP and DBP by 6.9 and 3.7 mmHg, respectively), compared to non-African Americans (SBP and DBP by 3.3 and 2.4 mmHg, respectively), with the effects on BP reductions (SBP and DBP by 11.6 and 5.3 mmHg, respectively) being more profound in hypertensive than in nonhypertensive individuals (SBP and DBP by 3.5 and 2.2 mmHg, respectively). In another trial, the DASH diet significantly lowered BP at each of three sodium levels. A total of 412 individuals with or without hypertension, were randomly assigned to eat either a control typical US diet or the DASH diet. Participants consumed foods with high, intermediate, and low levels of sodium for 30 days each, in random order. Comparing with high, intermediate sodium intake reduced SBP levels by 2.1 mmHg during the control diet and by 1.3 mmHg during the DASH diet. Moreover, changing from the intermediate to the low level of sodium intake resulted in additional reductions of 4.6 mmHg during the control diet and 1.7 mmHg during the DASH diet. The range of reduction between control diet with high sodium intake and DASH diet with low sodium intake for a mean SBP was 7.1 mm Hg lower for nonhypertensive individuals and 11.5 mmHg for hypertensives. Researchers concluded that the combination of both the decrease of sodium intake below 100 mmol per day and the DASH diet had a stronger impact on lowering BP rather than each factor alone.[12]

Long-term effects of DASH diet in overweight hypertensives that participated in the ENCORE study, and were followed 8 months after the end of

their 16 weeks treatment, showed some beneficial impact on BP, exercise, and body weight control. However, effective methods that promote permanent lifestyle modification are needed.[13]

Traditional Mediterranean diet

Improvement of daily dietary habits can reduce high BP levels and postpone or even totally prevent, if adopted for a long period, the presence of hypertension.[2] A study conducted in 1950 showed that Cretan people live longer than in other Europeans and have a lower prevalence of myocardial infarctions, ischemic stroke, and some types of cancer.[14] This observation prompted the researchers to further study the nutrition profile and characteristics of the general Mediterranean area.

The characteristics of the Mediterranean diet (MD) are[15]:

- high content of monounsaturated fatty acids (MUFA) and polyunsaturated fatty acids (PUFA),
- medium consumption of alcohol and dairy products,
- increased intake of pulses, fruit, and vegetables, and
- low consumption of red meat and its products.

The diet of the Mediterranean countries is not amended in a kind of diet rather characterized by common everyday food choices. Major food choices in MD are fruits, vegetables, nuts, seeds, wine, fish, legumes, cereals, bread, milk, olives, and olive oil which are rich in fiber, phenols, flavonoids, isoflavones, phytosterols, and plant acids that are important bioactive ingredients and contribute to the metabolism. In addition, fish, olives, and olive oil are rich in MUFA, PUFA, and phytochemicals (polyphenols, alpha-tocopherol), which have pleiotropic beneficial effects on the cardiovascular and nervous system.

In the SUN study, involving 9408 men and women followed for six years, the implementation of the MD was associated with a decrease in SBP and DBP values. Moderate implementation of the MD showed a decrease of 2.4 mmHg for SBP and 1.3 mmHg for DBP; while more systematic application decreased SBP and DBP by 3.1 and 1.9 mmHg, respectively.[16] Additionally, the adoption of the MD in 772 subjects (55–80 years), in high risk for CVD, resulted in SBP reduction of 7.1 mmHg.[17]

In the ATTICA study, 1188 volunteers without CVD, but with increased (at levels of prehypertension) BP values, following a normal MD, were studied for five years for the development of hypertension. Of the 798 who returned for BP monitoring after six years, only 18.7% of men and 24.6% of women were diagnosed with hypertension.[18] In a recent meta-analysis, involving 50 primary studies and 534,906 individuals, results showed that adopting MD, lowers the incidence of the metabolic syndrome. Furthermore, MD was associated with a decrease in SBP (−2.35 mmHg) and DBP (−1.58 mmHg) levels. Additionally, it improved other components of the metabolic syndrome (waist circumference, lipid profile, glucose levels).[19]

The mechanisms by which MD impacts BP levels are not fully understood. There is more likely a multifactorial beneficial effect rather than an effect of one major nutrient. It appears that the adoption of eating habits such as those of the MD may have preventive and therapeutic effects against hypertension and other CVD. However, other factors that characterize the peoples of the Mediterranean such as physical activity, exposure to sun, and fresh seasonal products should be also considered.

Nutrient supplementation

Potassium and magnesium, found rich in fruits and vegetables, have been mostly studied for beneficial effects against hypertension. Recent analysis of 15 RCTs for potassium supplementation (75–125 mmol per day) in 917 normotensive and hypertensive patients without any antihypertensive medication, showed a reduction in SBP by 4.7 mmHg and in DBP by 3.5 mmHg in all patients, an effect that was stronger in hypertensives by 6.8 and 4.6 mmHg for SBP and DBP, respectively. Despite the results, researchers supported that potassium is not the only determining factor for the reduction of BP levels due to several parameters correlated with BP levels. Additionally, the ratio of sodium/potassium (Na/K) along with levels of potassium supplementation can be a better marker explaining the effect on BP levels.[20] On the other hand, an analysis of 34 trials involving 2028 normotensive and hypertensive patients, showed a positive effect of Mg supplementation (368 mg/d) for three months, in lowering SBP by 2.0 mmHg and DBP by 1.78 mmHg. Again the researchers supported that residual heterogeneity may still exist.[21] Future studies are needed to clarify the effects of K and Mg supplementation in the management of hypertension.

Body weight and EH

Impact of body weight control in BP levels

Over the last decades, a number of studies have been conducted on the association between excessive body weight and increased BP. Weight is categorized using body mass index (BMI) and overweight is considered when BMI ranges between 25 and 29.9 kg/m^2, while obese for values above 30 kg/m^2.[22] According to

WHO, obesity is currently considered as a developing disease for the general population and is caused by a variety of factors.

The role of obesity and reduction of body weight

Excessive body weight is linked with sodium retention, increased vascular resistance and elevated cardiac output. Hypertension is linked with increased body weight without a clear pathophysiological explanation. Nevertheless, possible underlying mechanisms are: (a) hyperinsulinemia and hyperleptinemia that lead to reabsorption of sodium by the kidneys, b) increased activity of sympathetic nervous system, and c) elevated retention and reabsorption of sodium due to low glomerular filtration, increased intraventricular pressure and hyperactivity of renin in the renin-angiotensin system.[23]

In the Framingham study, hypertension was related to obesity in 70% of men and 60% of women; whereas, increase of body weight by 10 kg had a positive impact on BP by 7 mmHg.[24] These data come to an agreement with the results of Huang et al.[25] that monitored 82,473 women for 16 years and found that an increase of BMI by 1 kg/m^2 increases the possibility of hypertension development by 12%.[25]

In TOHP I study, overweight patients (around 115–165% of their normal weight) aged 30–54 years old with DBP of 80–90 mmHg, were monitored for 6, 8, and 12 months. A reduction in body weight by 6.5, 5.6, and 4.7 kg for men and for 3.7, 2.7, and 1.6 kg for women had a negative effect on SBP levels for men and women by 3.1 and 2 mmHg, respectively. Regarding DBP levels, a reduction by 2.8 mmHg in men and 1.1 mmHg in women was also found. Interestingly, the higher the body weight reduction was, the higher the reduction in BP.[26] In hypertensive patients, aged 60–80 years old, who were under antihypertensive medical treatment, body weight reduction by 3–9 kg, had an impact on lowering the medication dose by 25% after 29 months of monitoring.[27]

Maintaining normal body weight to control BP

Lowering excessive body weight through enhancement and finally improvement of nutritional behavior, based on a hypocaloric diet, is achieved effectively with a regular basic patient training, at least in short terms, in hypertensive patients with BMI above 30 kg/m^2.[28] In TOHP II study of prehypertensive individuals (DBP 83–89 mmHg and SBP lower than 140 mmHg) with body weight 110–165% above normal, only 13% succeeded to maintain a body weight loss higher than 4.5 kg for more than 36 months. Patients who achieved to reduce their body weight in the first 6 months by 4.5 kg had a 65% lower risk of developing hypertension and for those who lost less than 4.5 kg the risk was 35% lower at the end of the 36-month period.[29] Same results were found in TOHP I study where patients were subjected to an 18-month weight reduction program. After 7 years of follow-up, the risk of developing hypertension was significantly lower for individuals who lost weight compared to those who did not (18.9% compared to 40.5%). Additionally, losing excess weight had a positive impact, in the long term, on controlling BP levels and minimized the incidence of hypertension.[30]

Although available data strongly suggest that body weight reduction in obese and overweight will help to control BP levels, emphasis should be given on how to maintain a healthy body weight in order to prevent or manage hypertension.[3]

Exercise to improve BP levels

Physical activity is a major lifestyle intervention in prevention and management of hypertension and other cardiovascular risk factors. Studies strongly support dose-related response of physical activity to hypertension, through beneficial effect on BP levels. Higher fitness level is associated with lower probability and incidence of hypertension which has been strongly supported over the last decades.[31]

Even an earlier analysis of 54 randomized controlled trials (RCTs) with 2419 participants showed that aerobic exercise was associated with a significant reduction in SBP and DBP (3.84 and 2.58 mmHg, respectively). Researchers supported that aerobic exercise was associated with lower BP levels in individuals with normal BMI and BP levels, as well as in those with increased BMI and higher BP.[32]

However, regarding strength training, questions remain as to whether the effect is significant in hypertensive patients. In a meta-analysis of 28 RCTs, with 1012 participants in 33 subgroups, a significant decrease in BP levels was found in 28 normal subgroups, although there was no significant reduction in the 5 hypertensive subgroups.[33]

Despite the importance of exercise in prevention and management of hypertension in high risk individuals, many unanswered questions still remain about the protective benefits of physical activity and the variety of factors that may influence the relationship between physical activity and hypertension, as well as the individualized instruction profiles to prevent hypertension and further research is needed.

Conclusion and future perspectives

EH is a major health problem that affects more than 30% of the adult general population and places them at

risk for CVD. Management of hypertension requires both pharmacological and nonpharmacological interventions. It has been clearly stated from a number of studies that the way of living affects BP levels. Research has shown that nonpharmacological interventions may help address EH. More importantly, lifestyle factors that may play a role include poor diet (high sodium and alcohol consumption, low fruit and vegetable consumption), smoking, low physical activity, stress, and increased body weight. Targeting lifestyle changes includes maintaining a healthy body weight, avoiding smoking, limiting alcohol consumption, increasing physical activity, and adopting better quality nutrition interventions. Nutrition parameters can be addressed through therapeutic diet models, among which predominant seem to be the DASH diet and the Mediterranean diet. Concerning hypertensive individuals with higher BMI, immediate weight loss must be one of the first nonpharmacological intervention. For most researchers, aerobic exercise is the preferable way of exercising in order to treat EH, with conflicting evidence for other forms of exercise.

Nevertheless, lifestyle improvement is a dynamic procedure that takes training, repeatable interventions and an adoption period of applying the guidelines rather than a simple and short-term approach to that way of treatment. Additionally, as high BP levels occur more in Western type and developed countries, in which living conditions are characterized by a stressful, low physical activity, and poor nutrition quality choices, strategies for improving quality of life in the general population are needed. These could lead to prevention as well as to reduction in the prevalence and incidence of EH.

In conclusion, in order to treat EH based on nonpharmacological interventions, a multifactorial approach is needed, targeting at a more permanent and finally less physician depended, improved quality for nutrition, physical activity few times per week, and normal body weight. Although a number of studies have been conducted in the field, more extensive and better designed research is necessary to provide better understanding of the optimal approach.

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