THE ROLE OF DIETS IN PREVENTION AND HYPERTENSION THERAPY

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Abstract

Hypertension is one of the public health problems in the world in the last decade. Various studies show hypertension is a major risk factor in the occurrence of stroke, ischemic heart disease, and kidney failure. Hypertension therapy can reduce the risk of stroke by 40% and myocardial infarction risk by up to 15%. Lifestyle changes that are part of the management of hypertension can reduce blood pressure, increase the effectiveness of antihypertensive drugs, and reduce cardiovascular risk. Modification of daily food intake patterns is one component of lifestyle changes that have the greatest role in lowering blood pressure. Modification of food intake patterns referred to is to follow the general guidelines for balanced nutrition also in accordance with the dietary approach to stop hypertension (DASH), which is high in vegetables and fruit, high-fiber foods, low-fat milk, meat, and nuts. It should also be noted that energy intake, the amount and type of protein, and fat and carbohydrate components. In addition, foodstuffs are rich in minerals and vitamins, and specific nutrients, such as omega-3 unsaturated fatty acids have a role in the prevention and management of hypertension.

***Keywords**: dietary approaches to stop hypertension (DASH), hypertension, diet modification, lifestyle modification*

A. INTRODUCTION

Today, the prevalence of hypertension continues to increase both in developed and developing countries. It is estimated that in 2025 there will be a 35% increase in hyper prevalence in adulthood in adulthood compared to 2000.1 Increased blood pressure can be influenced by genetic and environmental risk factors, namely daily food intake, physical activity, toxins, etc.[2]

Hypertension is an important risk factor for coronary heart disease, stroke, kidney disease, and retinopathy.[3] Adequate hypertension therapy can reduce the risk of stroke by 40% and the risk of myocardial infarction by up to 15%. A report from the joint national committee on prevention, detection, evaluation, and treatment of high blood pressure (JNC 7) recommending lifestyle modification as an important therapy in hypertension.3 Modification of daily food intake is one part of lifestyle modification that has a significant role great in preventing blood pressure increases in individuals who do not suffer from hypertension, as well as lowering blood pressure in prehypertension and hypertension sufferers.[2] Today various studies show that some nutrients, certain foods, daily food intake / diet patterns include The Dietary Approaches to Stop Hyper-tension

(DASH) play a role in the prevention and treatment of hypertension.5 This article will describe the role of substances nutrients in the diet and patterns of daily food intake in the prevention and management of hypertension.

B. METHOD

This research approach uses a system of qualitative analysis in which the process of qualitative study carried out by researchers through literature and studies related to the subject is carried out. Qualitative research character is a comprehensive narrative, in which the researcher attempts to perform a thorough analysis of the research question such that the analysis can be performed from many aspects. In this way the research is expected to be able to visualize the problem clearly and completely.

C. RESULT AND DISCUSSION

Hypertension and Risk Factors

Hypertension is a state of increased blood pressure that occurs chronically and can result in organ damage and increase morbidity and mortality. Because of chronic events, often an increase in blood pressure is not detected early and treatment is often irregular even after diagnosis. Hypertension is a major risk factor for various cardio-vascular diseases including coronary heart disease, stroke, kidney disease, and retinopathy.[3] Knowing the causes or risk factors for hypertension is important for the prevention and management of adequate hypertension in an effort reduce the risk of cardio-vascular disease.

Risk factors for hypertension can be grouped with risk factors that cannot be modified, such as age, gender, race; and which can be modified, namely lifestyle. Research that has been done shows that lifestyle modification can reduce blood pressure and increase the effectiveness of pharmacologic therapy. Therefore, lifestyle modification is recommended in various guidelines for hypertension therapy in addition to pharmacologic therapy. [3,6] Most lifestyle factors are related to dietary factors / daily food intake, including types of macronutrients and micronutrients as well as nutritional status with -more / overweight. This paper will describe food intake factors, both those that have a risk of increasing and those that can reduce blood pressure.

Macronutrients

Some studies show there is a role for macronutrient intake in hypertension, but others show controversial results. This situation is suspected because generally daily food intake consists of three macronutrient components, so it is difficult to know the impact of each type of macro-nutrient on the risk of hypertension. In addition, one part of the study

shows the number and part factors of each type of macronutrient also contribute to the occurrence of hypertension.

1. **Carbohydrates**

Research into the role of carbohydrate intake in the occurrence of increased blood pressure shows varied results. Some research shows that carbohydrates increase blood pressure, but if some carbohydrates are replaced with protein or monounsaturated fatty acids, the composition can reduce blood pressure.

Recently there has been a lot of research on the effects of carbohydrate components, namely sucrose and fructose on hypertension. Most of the results of studies in both experimental and human animals show that sucrose and fructose intake can increase blood pressure. Although the results of the study show that both of these substances play a role in increasing blood pressure, it has been proven that fructose which is a component of sucrose is the main substance that plays a role in increasing blood pressure. Martinez et al. reported the results of his research that dog animals that received a high-fructose diet experienced elevated blood pressure, plasma triglycerides, and hyperinsulinism, whereas dogs who got a high-glucose diet did not experience this.[9] Human studies have also shown that the effects fructose consumption differs from glucose with respect to blood pressure, where fructose can increase blood pressure, whereas glucose does not. Jalal et al., The results of his study showed that individuals without a history of hypertension consuming fructose 74 g / day from diet or sugary drinks can increase the risk by 30% to have blood pressure 140 / 90 mmHg. The amount of fructose is equivalent to 2½ packs of sugar-sweetened drinks / day.[10]

In daily food, fructose in the diet can be obtained from sweet drinks, bakery products, fruit drinks, confectionery, and sweet cakes. The mechanism by which fructose increases blood pressure is still unclear. The fructose effect is thought to be caused by several factors including increasing the sympathetic nervous system, decreasing sodium excretion in the urine, increasing absorption of sodium in the gastrointestinal tract and through the production of uric acid which can reduce the intrinsic nitric oxide vasodilator product.[10] Some studies have been carried out showed the role of fructose in increasing blood pressure was not related to the amount of calorie intake and weight gain. Although the mechanism is not well known, reducing consumption of one to two sweet drinks per day can reduce systolic blood pressure by 3-4 mmHg.

2. **Protein**

Epidemiological and observational studies that have been conducted show that there is an inverse relationship between protein intake and blood pressure. Research conducted by Stamler et al., On 10020 men and women in the International study of Salt

and blood pressure (INTERSALT) shows that high protein intake has a better effect on blood pressure.[12] Wang et al. revealed from the results of his research that high protein intake, especially vegetable protein, can significantly reduce blood pressure, whereas animal protein intake or total protein intake did not produce significant results.[13] In contrast to the research that has been done, He et al. suggests from the results of his research that animal protein derived from milk can reduce blood pressure in accordance with vegetable protein from soybeans in patients with hypertension and stage I hypertension. In this study, the calcium and potassium content of milk have been synchronized with the bean pro-tein soybeans and carbohydrates, so the effect of decreasing blood pressure obtained from milk protein is not affected by the two minerals.

The mechanism of total protein intake or vegetable protein in lowering blood pressure is not yet clearly known, but it is suspected that there are several mechanisms. The first mechanism, high protein intake will increase plasma amino acid concentrations which can stimulate sodium excretion in the kidneys, so that blood pressure decreases. Other mechanisms include certain amino acids, including cysteine, glutamate, glutathione, arginine, leu-sin, taurine, and tryptophan from proteins which have antihypertensive effects. The effect of these amino acids in lowering blood pressure by improving insulin resistance and glucose metabolism. This condition will further reduce the formation of advanced glycation end products (AGE), reduce oxidative stress, decrease vascular intracellular calcium, increase nitric oxide (NO) production, all of which will improve endothelial function and decrease peripheral vascular resistance results in decreased blood pressure.[15] Research on the effects of milk protein in lowering blood pressure shows through the role of an-giotensin-I-converting enzyme (ACE) inhibitory peptides. Milk proteins, such as casein and lactalbumin, are rich in ACE inhibitory peptide, which are casokinins and lactokinins that can inhibits the hydrolysis of angiotensin I to vasoconstriction angiotensin II. Both peptides can be released by hydrolysis enzymes during the process of digestion in the digestive tract or during the processing process.

3. Fat

The effect of total fat intake on blood pressure is not yet clearly known and is still controversial.2 Further studies of the composition of fatty acids which are components of fat show that fatty acids have different effects on blood pressure. Grimsgaard et al., Showed that total fatty acids, saturated fatty acids (SFA), and unsaturated fatty acids (UFA) linoleic acid, each of which can affect blood pressure differently.[16]

Studies in experimental animals and humans have shown that high SFA intake can increase systolic blood pressure. Other researchers have shown that diets high in monounsaturated fatty acids (MUFA) can reduce blood pressure in healthy individuals

whereas, diets high in SFA do not provide changes in blood pressure. However, the role of MUFA will be lost if the total fat intake is more than 37% of total energy.[17] Unsaturated fatty acids can inhibit the effectiveness of dairy products in lowering blood pressure. This situation is shown in studies in which dairy products have an inverse effect on pressure only in dairy products that are low in SFA content. Based on these studies, it was shown that SFA had a direct effect with blood pressure, whereas MUFA had an opposite effect with blood pressure. The amount of fat intake also influences the effect of MUFA on blood pressure. The effect of SFA on blood pressure is still not clearly known, but it is suspected that SFA can affect arterial endothelial function, so that it becomes stiff / hard resulting in increased blood pressure.[16]

Polyunsaturated fatty acids (PUFA) ω -6 and ω-3 have the effect of reducing the risk of hypertension. Miura et al. in the International Study of Macro-Micronutrients and Blood Pressure (INTERMAP) shows an inverse relationship between PUFA ω-6 intake and blood pressure. The study involved 2238 men and women aged 40-59 years who had not yet taken a diet or were taking antihypertensive, antihypertensive, or cardiovascular drugs. The effect of PUFA ω -6 on blood pressure is thought to be influenced by prostaglandin meta-bolism (PG) produced from PUFA ω -6, namely PGI2 and PGE2 which are vasodilators.[18] The intake of PUFA 3-3 also has an opposite effect with blood pressure. A meta-analysis study showed that administration of PUFA ω -3 in the form of supplementation to sufferers of hypertension can reduce blood pressure, but has no effect on non-hypertensive individuals.[2] In contrast to previous studies, Ueshima et al., Reported administration of long-chain PUFA ω-3 derived from fish can lower blood pressure greater in nonhypertensive subjects. The effect of PUFA ω -3 on blood pressure is thought to be T-3 PUFA can strengthen the vascular endothelial vasodilation function and decrease the reactivity of vascular smooth muscle.

Micronutrients

The role of each type of micronutrient against the risk of hypertension is difficult to ascertain, because there is no single foodstuff that only contains one type of micronutrient. Therefore, to find out the role of micronutrients in blood pressure, a study was conducted with intervention using supplements. In this paper we will describe the minerals that have been extensively researched, namely so-dium, potassium, calcium, and magnesium and vitamin C.

a. Sodium

Most of the results showed there was a relationship between sodium intake and blood pressure. The Norfolk Cohort of the European Prospective Investigation into

Cancer study using sodium urine as an indicator of sodium intake, also shows there is a correlation between sodium intake and hypertension risk.[20] The Dietary Approaches to Stop Hypertension study shows a decrease in sodium intake from 3 g / day to 2.3 g / day decreased systolic / diastolic blood pressure by 2.1 / 1.1mmHg in the control diet group and 1.3 / 0.6 mmHg in the DASH diet group. Decreasing lower sodium intake, which is 1.5 g / day, there is a decrease in pressure greater systolic and diastolic blood, 4.6 / 2.4 mmHg, in the control diet group and 1.7 / 1 mmHg in the DASH diet group. The pathophysiology of increased blood pressure induced by sodium involves several mechanisms. In good health, sodium will be excreted through the kidneys. In a situation where the kidneys are unable to excrete sodium as a result of damage / inability of the nephron to excrete sodium, sodium retention will occur. This situation subsequently results in intravascular volume expansion and an increase in blood pressure. In addition, high sodium with low potassium content can affect the contraction of vascular smooth muscle cells resulting in an increase in peripheral vascular resistance and subsequently an increase in blood pressure.

b. Potassium

Animal studies, epidemiology, ob- servational studies, clinical trials, and meta-analysis have proven that potassium has an inverse relationship with blood pressure.[2] INTERSALT studies show that a decrease in potassium excretion in urine of 50 mmol / day is related with an increase in systolic pressure of 3.4 mmHg and diastolic pressure of 1.9 mmHg. In addition, it was also conveyed that the ratio of potassium / sodium in urine was inversely significant with blood pressure.[21] Clinical research showed that a low intake of potassium of 10-16 mmol / day accompanied by the usual intake of sodium in the range of 120-200 mmol caused -Dan sodium retention and increased blood pressure. The results showed that with potassium and sodium intake, an increase in systolic and diastolic pressures of 6 mmHg and 4 mmHg in normotensive subjects, and in hypertensive subjects an increase in systolic and diastolic pressure was increased by 7 mmHg and 6 mmHg.[21] Conversely, research conducted by Whelton et al., showed that an increase in potassium intake of 1.8-1.9 g / day was proven to reduce systolic blood pressure by 4 mmHg, and diastolic 2.5 mmHg in hypertension individuals and by 1.8 mmHg and 1.0 mmHg in non-hypertensive individuals.[2]

The role of potassium in influencing blood pressure is not known with certainty, but several studies have demonstrated its role through several mechanisms involving kidney function, sodium intake, and calcium. The balance of potassium in the plasma is regulated by the kidneys by excreting it through urine. The kidneys are responsible for 90% of potassium excretion and the remainder through faeces. Potassium has the nature of natriure-sis, but in a state of deficiency will be disrupted its function, so that the so-

dium will be more retained and blood pressure increases. Low potassium intake will cause the body to experience potassium deficiency and if accompanied by high sodium intake, the body will increasingly lack potassium. In conditions of high sodium intake, sodium will be reabsorbed in the cortical collecting tubule and pota-pum will be excreted, resulting in potassium deficiency.[22] In addition, high potassium intake can increase vasodilatation of endothelium through potassium reducing intracellular calcium, thereby decreasing potassium deficiency. - smooth muscle traction and blood pressure will decrease.

C. Calcium and Magnesium

Calcium and magnesium are nutritional factors that have been widely studied, but their effects on blood pressure are still unclear and not enough to be recommended as a therapy for lowering blood pressure.[2] Metaanalysis clinical trial studies found calcium supplementation of 1g / day has an effect that is not too large for a decrease in systolic and diastolic blood pressure, ie 1.9 mmHg and 1.0 mmHg.23 The same results were obtained from a randomized clinical trial study for 2 years with calcium supplementation of 1.2 g / day obtained The reduction in systolic and diastolic blood pressure is not significant.[24] The mechanism of calcium in reducing blood pressure is thought to have calcium competing with sodium to be reabsorbed in the proximal tubule, so that sodium is excreted (natriuresis). In addition, calcium supplementation can also increase the concentration of vasodilator hormone.[24]

The effect of magnesium on blood pressure from various studies is still controversial. Observational studies show there is an inverse effect of magnesium on blood pressure. However, a meta-analysis of 20 randomized clinical trials did not show any effect of magnesium on blood pressure.[2] The results of research conducted by Maheri et al., Showed serum magnesium levels in hypertensive patients were not different from normal individuals as controls. [25] Based on research that has been done, it can be recommended to consume magnesium according to your needs, but magnesium supplementation is not recommended as part of antihyperence therapy.

D. Vitamin C

Research that has been done shows that 10 of 14 cross-sectional studies of plasma vitamin C levels and three of four studies of vitamin C supplementation found an inverse relationship with blood pressure.[2] Seven randomized clinical trials showed no consistent effect between the effects of vitamin C with the effect of vitamin C blood pressure and even one study showed that there was an increase in blood pressure with vitamin C supplementation for a long time. Based on the results of research that has been done shows that the effect of vitamin C is not yet clear on blood pressure.

Overweight

Research that has been done shows that there is a direct relationship between body weight and blood pressure.[2] Framing-ham research shows that an increase in body weight of 10% can increase systolic blood pressure by 7 mmHg.[2] Bramlage et al. stated the relationship between the degree of obesity and the prevalence of hypertension. The results of his study showed a prevalence of hypertension of 34.3% in populations with a normal body mass index (BMI), 60.6% in patients with excess nutritional status, 72.9% in patients with first-degree obesity, 77.1% in patients with obesity is 2 and 74.1% in obese patients degrees 3.[2] Conversely, weight loss can also provide a decrease in blood pressure. The trial of hypertension prevention (TOHP) shows that weight loss of 2 kg can reduce systolic and diastolic blood pressure by 3.7 mmHg and 2.7 mmHg.[27]

The pathophysiology of increasing body weight against blood pressure is a complex mechanism. It is suspected that obesity results in hypertension through increased activation of the angiotensin aldosterone system, sympathetic nervous system activity, insulin and leptin resistance, procoagulatory activity, and endothelial dysfunction. In overweight / obesity there is an increase in sodium reabsorption in the kidney and disruption of natriuresis and an increase in fluid volume.

Modification of Diet

Dietary approaches to stop hypertension (DASH) are the recommended dietary patterns in the Sev- er Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7) for all patients with hypertension. Dietary patterns following this DASH pattern include high in fruits, vegetables, low-fat dairy products, low fat intake and low saturated fat, cholesterol, whole grains, fish, poultry, and nuts; reducing red meat, sugar, and sweet drinks.[3] This dietary pattern according to DASH is rich in potassium, magnesium, calcium, fiber, and a little high in protein.[2]

Research involving research subjects with the highest systolic blood pressure of 160 mmHg and diastolic pressure of 80-95 mmHg, running a food intake pattern according to DASH for 2 weeks showed there was a decrease in systolic blood pressure of 5.5 mmHg and diastolic pressure of 3.0 mmHg. In that study, the greatest decrease in blood pressure was found in the population who followed the DASH diet compared to subjects who took the normal diet consumed by the American public and a normal diet supplemented with vegetables and fruit. [28]

E. CONCLUSION

Macro and micronutrients have a role in the prevention and treatment of hypertension. Intake of vegetable protein rich and protein products from milk (low fat), monounsaturated fatty acids, double ALTJ, and potassium and limitation of sodium and fructose intake play a role in the prevention and treatment of hypertension. In addition, weight loss or maintaining weight within normal limits and changes in dietary patterns according to The Dietary Approaches to Stop Hyper-tension are also recommended for the prevention and treatment of hypertension. Various other nutrients, such as calcium, magnesium, vitamin C can also affect blood pressure, but their effectiveness is still unclear and further research needs to be done.

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