

Potential Application of Mediterranean Diet and DASH Diet and Plant-Based Diet in Solving the Problem of Hypertension in Women

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Abstract. The food industry is thriving due to economic prosperity. People's food requirements have expanded beyond mere sustenance to include a desire for diversity. However, long-term pressure from heavy work or family responsibilities may cause women to develop irregular dietary habits, leading to obesity and related health issues. As hypertension is a significant contributor to cardiovascular disease, this paper compares the advantages and disadvantages of three popular diets: the Mediterranean diet, the DASH diet, and the plant-based diet. The paper discusses the pros and cons of each diet to determine which one is more suitable for the female to prevent and alleviate hypertension symptoms. By comparing the regional, quantitative, nutritional value and public acceptance of three different diets, it is concluded that the plant-based diet which consists of fruits and vegetables in addition to nuts, seeds, whole grains, and legumes, is more suitable as a daily diet for women to alleviate hypertension symptoms.

Keywords: Hypertension; Female; Plant-based diet; Mediterranean diet; DASH diet.

1. Introduction

Hypertension is a significant contributor to cardiovascular disease. Factors that could trigger hypertension include salt intake, age, obesity, sedentary behavior, and alcohol consumption. Salt intake is considered the primary factor that influences an increase in blood pressure. Excessive salt intake, beyond the daily requirement, can lead to an increased risk of obesity.

Approximately 70% of arterial hypertension is linked to obesity, according to recent studies from Henry and her team. Obesity-associated hypertension poses a sex-specific risk, with higher obesity rates and severity observed in women. Obese women are also less likely than men to have adequate blood pressure control.

Excessive intake of red and processed meats and low intake of dietary fiber are the biggest contributing factors, as commonly stated that health issues could often be traced back to poor dietary habits. Correcting poor dietary habits and choosing a balanced diet with reduced sodium intake can help reduce obesity and lower blood pressure. Therefore, three diets with a greater proportion of dietary fiber intake were selected for analysis. The objective of this study is to compare the generalizability and pervasiveness of three diets - the Mediterranean diet, DASH diet, and plant-based diet - among women, and their effects on hypertension.

2. Pathogenesis of Hypertension in Women

Hypertension is a significant risk factor for global diseases, which has the most significant impact of all risk factors for cardiovascular disease[1]. In the United States, female have a higher life expectancy more than male in gender since the turn of century. The increase situation in life expectancy is due to reduction in maternal mortality. However, female have higher rates of hypertension morbidity and reason than male[2].

Recent studies illustrate that around 70% of arterial hypertension has connection with obesity[3]. With life quality improvement, the more and more food products choices could be purchase by consumers. The impact of high pressure of a fast-paced life leads to an increasing consumption on convenience food or high-calorie food which is the culprit of obesity. The risk of hypertension related

to obesity is specific to sex. The population rates of obesity of female and its prevalence are higher than that of male, regardless of their country or socio-economic status. Compared to men, women have stronger relatedness between high blood pressure and obesity[4].

A recent study by Gudmundsdottir and colleagues found that women are at a higher risk of developing high blood pressure than men[5]. From the available data, it can be concluded that there are sex differences in blood pressure in both animals and humans. In humans, blood pressure levels are lower in women than in men until the age of 60 to 70 years, at which time blood pressure levels gradually become comparable in women and men. It is therefore hypothesized that there is a close link between female hormones and sodium, and therefore blood pressure. An animal model was developed in which female rats had less hypertension than males when Dahl salt-sensitive (DS) rats were fed a high-sodium diet. Gonadectomy accelerated the development of salt-sensitive hypertension in females. This led to the conclusion that endogenous and exogenous female hormones profoundly influence the systemic and renal responses to salt in females. With increasing age, young post-menopausal women become salt sensitive. According to an experiment by Pechère-Bertschi, Antoinette and Michel Burnier, there was a proportional increase in weight in women who switched from a low-salt diet to a high-salt diet[6]. However, this was particularly significant in menopausal women (comparable change in sodium intake of 2.5 kg). It was therefore concluded that salt-induced weight change was a strong determinant of blood pressure (BP) change.

3. High Salt Diet

For millions of years, technology for salt refining was underdeveloped which made humans salt intake less than 0.25 grams per day. With the transformative for civilized societies, salt is as a tool to preserve food and extend shelf-life. Salt intake subsequently increased to be around between 9 and 12 g/day in most countries, high salt diet becomes a habit. Therefore, excessive salt intake which causes high blood pressure and increase high incidence of heart disease is known as high salt diet. Food variety leads to expansion of salt intake pathways. Bread, breakfast cereals, meat products and ready meals are a source of salt intake as people usually eat.

Based on the available evidence, it has demonstrated that there is a positive correlation between high blood pressure and salt intake (WHO)[7]. The INTERSALT study shows that person increase the salt intake of 6g/day, the systolic blood pressure elevated by 9 mmHg over 30 years. The research finding demonstrates that the theory is valid except for specific cases which is four extreme low salt intake populations[8].

High salt intake could be contributed to cardiovascular risk mainly through its effect on blood pressure, as well as its independent effects on arterial stiffness and albuminuria. Kidney is considered as a major regulator to balance salt, which is core to regulate blood pressure in long-term. Due to a decrease in the excretion of sodium by the kidneys, individuals are more vulnerable by high salt diet. The side effect of excessive salt intake is an increasing morbidity in chronic kidney disease [1].

4. The Mediterranean Diet

According to current Dietary Guidelines for Americans, the Mediterranean diet (MedDiet) is recommended optional eating habits[9]. The traditional Mediterranean diet is rich in fruit, vegetables, nuts and whole grains. The Mediterranean diet is limited red and processed meats, dairy products and sweets, but fish and poultry are moderate. The primary dietary fat recourse is olive oil. Olive oil is beneficial components has an effect on blood pressure. The risk of high blood pressure may be reduced in people who eat foods typical of the MedDiet. However, the MedDiet has the opposite effect on blood pressure levels when it comes to red and processed meat.

In the context of MedDiet, the effect of sodium intake on blood pressure is undefined. The original intention of promoting the Mediterranean diet was not to reduce or prevent the risk of hypertension,

while the Mediterranean diet (MedDiet) is the prevention and treatment of type II diabetes. Therefore, the MedDiet is recommended by the American Diabetes Association.

Another perspective acknowledges that the impact of the Mediterranean diet on high blood pressure is unclear. While the Mediterranean diet recommends the consumption of naturally low-sodium foods such as fruits and vegetables, the MedDiet does not provide specific guidelines for sodium intake. Recent research has not confirmed the theory that low sodium foods counteract the side effects of high sodium foods on high blood pressure[10].

5. The DASH Diet

The DASH diet is an eating pattern that focuses on eating fruits, vegetables and low-fat dairy. The diet is rich in whole grains, legumes, nuts, fish and poultry, and low in fat, red meat and sweets/sugary drinks. Sodium of the DASH diet is naturally low, while other micronutrients such as potassium, calcium, magnesium and fiber are high. Beneficial components of the DASH diet are the reduced content of sodium, trans/saturated/total fat, and dietary cholesterol.

The first discovery that the DASH diet had a role in lowering blood pressure was made 25 years ago in a DASH clinical trial that studied the effects of three different diets on blood pressure in two populations, adults with and without high blood pressure. The conclusion of the trial was that the DASH diet, a diet rich in fruits, vegetables and low-fat dairy products, could significantly lower blood pressure because of its reduction in saturated and total fats. Therefore, the DASH diet is considered a therapeutic approach to preventing and treating high blood pressure.

The effective dietary method widely recognized for lowering blood pressure is also the DASH diet. However, the mechanism of its antihypertensive effect is not fully understood. The DASH diet has been shown to be more effective in reducing blood pressure in specific populations, such as those with salt sensitivity. The principle for this theory is that the DASH diet seems to interact with the RAAS, enhancing some of the physiological effects of angiotensin-converting enzyme (ACE) inhibition and producing a diuretic effect. The DASH diet increases salt output at each blood pressure level, acting as a diuretic. Fruits and vegetables contain micronutrients such as potassium and calcium, which have been proven to regulate blood pressure and counteract the increase in blood pressure caused by dietary sodium. By looking at two different groups of people in the DASH on blood pressure trial, it was found that the DASH diet had a greater effect on lowering blood pressure in people with high blood pressure than in people without high blood pressure. However, high blood pressure leads to the development of other diseases that could affect blood pressure and thus reduce the blood pressure-lowering effect of DASH[10].

Salt, or dietary sodium, is considered the main factor responsible for changes in blood pressure, but reducing sodium intake on the DASH diet has no effect on blood pressure. According to Stephen and his teams' study, they combine low sodium intake with the DASH diet[11]. A sample of 412 individuals with an average age of 48 years was randomly assigned to either the DASH diet or a control diet in this trial. Participants in two groups were fed three different sodium levels in random order over four weeks, with a five-day break in between. The study found that in the control diet group, higher sodium intake was associated with a decrease in mean systolic blood pressure. When comparing the effects of high sodium intake with DASH consumption, the latter was associated with a higher decrease in mean systolic blood pressure differences, compared to controls (trend $p=0.66$). The study found that the low sodium DASH diet had a greater impact on reducing systolic blood pressure (SBP) compared to the high sodium control diet. Compared to the control diet, the DASH diet with low salt intake is low impact on lower blood pressure. Although the effects of low sodium intake and the DASH diet on blood pressure were smaller when implemented separately than when combined, they were still significant even when the effects of each dietary intervention were tightly controlled. According to the experimental data, the mechanism of nutrient interactions may result in a less significant impact of salt on reducing blood pressure (Fig. 1)

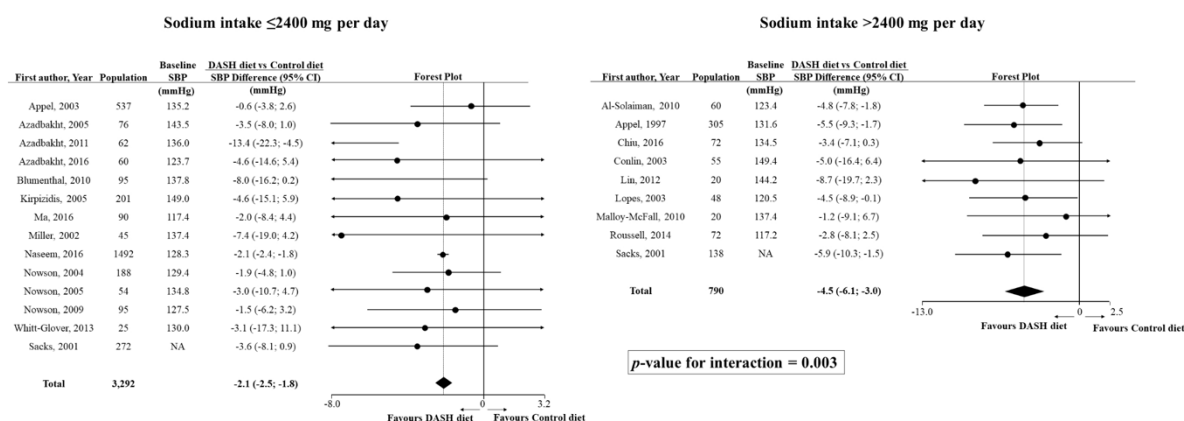


Fig. 1 Antihypertensive effects of the DASH diet in adults with and without hypertension: a subgroup analysis of trials of SBP outcomes based on daily sodium intake [10]

6. Plant-Based Diet

Various metabolic problems can result from a western diet high in sugar, salt, cholesterol and fat. Therefore, to improve poor eating habits, A plant-based diet is beginning to be more widely accepted by the general public, which is recognized as a healthier alternative to a diet laden with meat. The primary cause of death in the US is still atherosclerosis, which is associated with a diet high in meat, fat and carbohydrates[12].

The main aim of a plant-based diet is to maximize the consumption of nutrient-rich plant foods with decrease of processed foods, added sugars, oils and animal products. A plant-based diet may be defined as eating more fruit and vegetables and less fatty foods. Recent studies shows that a plant-based diet has significant benefits on health, which have effective treatment on obesity, hypertension and other heart diseases[12]. However, the plant-based diet is entirely different with eating diet of vegetarians and semi-vegetarians which is to eat a large number of plant-based foods, with less emphasis on the consumption of meat. Compared to the meat-centered diets, the plant-based diet increases food variety, which include grains, fruits, vegetables, legumes, nuts and seeds[13]. Plant-based diet is considered as a mixture of meat-centered diet and strict vegetarian diet which is acceptable by public.

Ghadeer and his team investigated the effect of health on the relationship between plant-based diets and blood pressure[14]. Participants who ate a vegetarian or vegan diet had a lower incidence of high blood pressure or hypertension compared to those who ate an omnivorous diet. A relationship was examined in which specific food groups modified the association with overall plant-based diet index (PDI) scores. The results of the experiment showed that intake of vegetables and whole grains with PDI scores explained the inverse association of healthy PDI (hPDI) with BP, whereas intake of refined grains, sugar-sweetened beverages and total meat with PDI scores explained the direct association of unhealthy PDI (uPDI) with blood pressure.

7. Comparison Between MedDiet, DASH Diet and Plant-Based Diet

The MedDiet is specific to the dietary habits of countries bordering the Mediterranean Sea, including Greece, Spain, France, and southern Italy. The Mediterranean diet is characterized by a high intake of fish, in addition to fruit and vegetables. However, this may not be feasible for those living inland.

The DASH diet has a functional effect of lowering blood pressure. However, there are certain drawbacks. Mutual constraints on the mechanism of action mean that its role in lowering blood

pressure is not very significant. Therefore, controlling the intake of red meat and processed meat is crucial to prevent it from affecting the antihypertensive effect of other nutrients[10].

Health plant-based diets that are healthy have higher levels of potassium and lower levels of micronutrients that can cause hypertension. This can have an impact on the renin-angiotensin system by reducing the effect of angiotensin on receptors and improving fluid-regulating hormones. As a result, this may help to improve or prevent hypertensive conditions.

Compared to the MedDiet and DASH diets, the plant-based diet may be more effective in reducing high blood pressure in women. In Ghadeer Aljuraiban and her colleagues' study, they find that Diet and lifestyle differences led to slightly weaker uPDI results in East Asian participants compared to Western participants. Among those with higher uPDI scores, East Asian participants consumed lower amounts of refined grains and dietary fiber compared to Western participants. The Chinese and Japanese diets have a lower daily fiber intake compared to the US diet. As these diets are closely related based on geography and culture, plant-based diets can be effective in balancing out geographic nutritional deficiencies that lead to increased blood pressure. A healthy plant-based diet does not necessarily equate to a vegan diet. It may include a moderate amount of animal foods, which could be beneficial for blood pressure. This is the advantage of a plant-based diet that distinguishes it from other diets.

8. Future Direction

Reducing salt intake has become a popular dietary trend as people are increasingly concerned about their health. Maintaining healthy eating habits is crucial for preventing disease and promoting overall physical well-being.

However, some young Asian women have adopted an unhealthy plant-based diet in their pursuit of a slimmer figure. This diet consists of consuming only vegetables and fruits to maintain their body functions, while minimizing their intake of salt, and refusing to consume other foods such as fish, meat, and dairy. It is important to note that this type of diet may not provide all the necessary nutrients for a healthy body. Theoretically, a low-sodium diet does not cause obesity, which can lead to hypertension. However, deficiencies in other nutrients may cause other disorders, such as hypoglycemia. Therefore, ensuring good health for the general public involves preventing and alleviating hypertension symptoms with a healthy plant-based diet, consisting mainly of foods of plant origin and a small amount of animal products.

9. Conclusion

This article explored risk factors for hypertension in women and suggests potential dietary responses. The blood pressure lowering effects of the Mediterranean diet, DASH diet and plant-based diet were analyzed and compared. The Mediterranean diet is a dietary pattern that emphasizes the consumption of vegetables, fruits, fish, grains, pulses, and olive oil. It is commonly followed in southern European countries along the Mediterranean Sea. While it has been shown to be beneficial for blood pressure, it may not be suitable for those living inland. Currently, there is a lack of studies confirming the effect of the Mediterranean diet on blood pressure. The DASH diet emphasizes the consumption of fat-free or low-fat dairy products, fish, poultry, pulses, and nuts while limiting high amounts of salt, sugar, and saturated fat. The DASH diet recommends reducing dietary sodium intake to lower blood pressure. However, experiments have shown that other nutrient intakes in the DASH diet interact with each other, which may significantly reduce the blood pressure lowering effect. The DASH diet is not recommended for the general public due to its reliance on academic knowledge, which may hinder its effectiveness. Therefore, it is not a suitable option for the general public. A plant-based diet offers the advantage of high fruit and vegetable intake, while excluding non-vegetarian foods such as meat, eggs, and milk. After comparing the three diets, it is concluded that a plant-based diet is more suitable for women. However, a plant-based diet does not mean a completely

vegetarian diet. People also need to consider the balance of nutrients to avoid becoming an unhealthy diet. The promotion of these dietary patterns should take into account possible incorrect application methods to avoid threats to public health.

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