

de Pourbaix Renata, Stępnik Jolanta, Maj-Gnat Katarzyna, Wołoszynek Eliza, Kielar Maciej. The role of food and nutrition in the prevention and pathogenesis of hypertension. *Journal of Education, Health and Sport*. 2019;9(3):375-380. eISSN 2391-8306. DOI <http://dx.doi.org/10.5281/zenodo.2598876>  
<http://ojs.ukw.edu.pl/index.php/johs/article/view/6712>  
<https://pbn.nauka.gov.pl/sedno-webapp/works/908117>

The journal has had 7 points in Ministry of Science and Higher Education parametric evaluation. Part B item 1223 (26/01/2017).  
1223 Journal of Education, Health and Sport eISSN 2391-8306 7

© The Authors 2019;

This article is published with open access at Licensee Open Journal Systems of Kazimierz Wielki University in Bydgoszcz, Poland  
Open Access. This article is distributed under the terms of the Creative Commons Attribution Noncommercial License which permits any noncommercial use, distribution, and reproduction in any medium, provided the original author (s) and source are credited. This is an open access article licensed under the terms of the Creative Commons Attribution Non commercial license Share alike. (<http://creativecommons.org/licenses/by-nc-sa/4.0/>) which permits unrestricted, non commercial use, distribution and reproduction in any medium, provided the work is properly cited.

The authors declare that there is no conflict of interests regarding the publication of this paper.

Received: 15.02.2019. Revised: 15.02.2019. Accepted: 20.03.2019.

## The role of food and nutrition in the prevention and pathogenesis of hypertension

mgr Renata de Pourbaix<sup>1</sup>, mgr Jolanta Stępnik<sup>1</sup>, mgr Katarzyna Maj-Gnat<sup>1</sup>,  
mgr Eliza Wołoszynek<sup>1</sup>, dr hab. Maciej Kielar<sup>2</sup>

1-Uniwersytet Jana Kochanowskiego w Kielcach, Wydział Lekarski i Nauk o Zdrowiu

2-Warszawski Uniwersytet Medyczny, II Wydział Lekarski z Oddziałem Nauczania  
w Języku Angielskim oraz Oddziałem Fizjoterapii, I Katedra i Klinika Chirurgii  
Ogólnej i Naczyniowej

### ABBREVIATIONS USED IN THIS WORK:

ABPM 24-hour registration of blood pressure; ambulatory blood pressure measurement,  
ambulatory blood pressure monitoring  
HBPM home measurements; home blood pressure monitoring  
PTNT Polskie Towarzystwo Nadciśnienia Tętniczego  
ESH Europejskie Towarzystwo nadciśnienia tętniczego; European Society of  
Hypertension  
ESC Europejskie Towarzystwo Kardiologiczne; European Society of Cardiology  
BP Ciśnienie tętnicze krwi; Blood Pressure  
DASH Dietary Approaches to Stop Hypertension

**Key words: food; nutrition; hypertension**

## SUMMARY

**INTRODUCTION** Arterial hypertension belongs to lifestyle diseases that are largely associated with abnormal lifestyle. Based on the results of the population research factors have been identified that increase the risk of hypertension, including: obesity, low physical activity, excessive alcohol consumption, use of diet rich in sodium and low in potassium, too low magnesium and calcium content in food and chronic stress.

**OBJECTIVE** The purpose of this article is to present the role of food and nutrition in the prevention and pathogenesis of hypertension.

**THE WEIGHT OF THE BODCIES** The influence of dietary intervention on blood pressure in patients with normal and high blood pressure was the subject of clinical tests [6,7].

The Dietary Approaches to Stop Hypertension (DASH) study involved a diet that promoted the intake of vegetables, fruits and small amounts of dairy products, contained whole grain cereals, fish, poultry and nuts, while limiting the amount of red meat in the diet, sweetness and sweetened beverages.

**SUMMARY** The DASH diet more effectively reduced the systolic and diastolic blood pressure both in hypertensive patients and those with normal pressure values. Following the low-sodium DASH diet is important in the strategy of prophylaxis and treatment of hypertension and related to that coronary heart disease, both at the population level and in dealing with individual patients.

Arterial hypertension belongs to lifestyle diseases that are largely associated with abnormal lifestyle. The current guidelines say that the diagnosis of hypertension should be established by repeated blood pressure measurements. According to ESH / ESC recommendations from 2007, the basis for the diagnosis of hypertension are clinical measurements - " 2 measurements made during each of at least 2 or 3 visits, although in particularly severe cases, these may be measurements made during one visit". The authors of the European guidelines emphasise that independent measurements and ABPM may help diagnose hypertension. The authors of the 2011 PTNT guidelines point out that hypertension can be diagnosed by properly performed clinical measurements if:

1. Mean blood pressure values (calculated from at least 2 measurements performed during 2 consecutive visits are  $> 140$  mm Hg for systolic pressure and/or  $> 90$  mmHg for diastolic pressure.
2. Mean blood pressure values (calculated from two measurements taken during one visit) are  $> 180$  mm Hg for systolic pressure and/or  $110$  mm Hg for diastolic pressure, excluding factors that increase pressure values, eg anxiety, pain, alcohol intake.
3. Based on reliable patient records or history ( the value of blood pressure or the fact of taking antihypertensive drugs). [10]

Patients with hypertension can be generally divided into two groups:

- Primary or idiopathic hypertension - in this prevalent group there are patients in whom the cause of hypertension remains unknown,
- Secondary or symptomatic hypertension - it concerns about 5% of all people suffering from hypertension, in whom elevated blood pressure is only a symptom of other diseases: kidney diseases, endocrine glands and particularly adrenal glands diseases, as well as malformations of large arteries. [15]

Multifactorial etiology of hypertension was reflected in various preventive methods, which were subject to clinical evaluation [11-13]. In persons with blood pressure above the reference values, but below the level considered as hypertension, the results of various lifestyle modifications were tested - both in short-term and long-term observations of

pressure reduction were evaluated. Studies have also been conducted in hypertensive patients to influence the various non-pharmacological methods of managing changes in the blood pressure level.

The results obtained allowed to draw the following conclusions:

1. Conducting an appropriate lifestyle is fundamental to the effectiveness of treatment of hypertensive patients,
2. The benefits of running a proper lifestyle also apply to people with normal blood pressure. Currently, in all guidelines, a change in lifestyle is recommended as the first step in the treatment of all hypertensive patients

Based on the results of the population research factors have been identified that increase the risk of hypertension, including:

- obesity,
- low physical activity,
- excessive alcohol consumption,
- use of diet rich in sodium and low in potassium,
- too low magnesium and calcium content in food and
- chronic stress [14]

The main clinical symptoms of hypertension are headaches, dizziness and a feeling of pressure. They are accompanied by a sense of weariness and a decline in life activity. If these symptoms persist for a long time, there are heartaches and a feeling of breathlessness after exercise. Chronic hypertension leads to damage to the left half of the heart with subsequent atherosclerosis. [16]

Recommendations on hypertension:

In hypertension, the supply of calories from food should be 1700-2000 kcal. Such amount helps to lower blood pressure,

It is important to limit in the diet saturated fat acids, whose source are products of animal origin (fatty meat and dairy products),

Excessive consumption of the protein raises the blood pressure and therefore the diet should abound in carbohydrates from fruit and vegetables, whole grain cereal products (coarse groats, dark whole-grain bread, spelled or wholemeal pasta, brown or wild rice),

The reduction of the amount of blood pressure has a large impact on reducing the amount of salt consumed. It should be replaced with potassium salt and mild spices: garlic (has a very beneficial effect on reducing pressure), basil, marjoram, mint and tarragon. Smoked, canned and pickled products as well as sticks, chips, crackers and fast food products are not recommended, because they contain a lot of salt,

We should increase the supply of vitamins, especially vitamin C (because diuretic drugs that are often used in hypertension lead to the excretion of vitamins along with the urine),

One should limit the consumption of beverages that can raise blood pressure such as: natural coffee, alcohol and strong brewed tea.

It is very important to use in the diet products that are rich in potassium, that acts hypotensive and regulates the work of the heart. The source of potassium are: potatoes, bananas, peaches, blackcurrants, brussels sprouts, garlic, parsley, legume seeds (beans, soy beans, chickpeas, peas, lentils) and wheat bran. The menu of people with hypertension should also contain walnuts.

In the diet it is necessary to consume the appropriate amount of fluids: 1.5-2.5 l of liquid a day in the form of still mineral water, freshly squeezed fruit and vegetable juices, not strongly brewed tea and green tea, [1,2,3]

Diet DASH (Dietary Approaches to Stop Hypertension) - right nutrition in hypertension

Vegetables and fruits due to the high content of potassium, fiber and vitamins E, C, beta carotene and folic acid should be found in every meal. Every day, at least 5 portions of fruit

and vegetables should be consumed (portion size: one glass of leafy vegetables, 1 glass of natural vegetable juice without salt, 1/2 cup of boiled cooked vegetables, 1 medium fruit, half glass of juice, 1/2 cup fresh or frozen fine fruit, 1/4 cup of dried fruits).

Whole grain cereal products, such as: whole grain, wholemeal and graham bread, buckwheat and barley, brown rice, rice pasta and oatmeal, due to the large amount of fiber and folic acid, B vitamins and minerals should be consumed more often than processed cereal products, such as light bread. The optimal consumption of cereal products is preferably 7-8 servings daily (portion size: 1 slice of wholemeal bread, 1/2 cup of cooked brown rice, groats or pasta, 30 g of oatmeal)

A good way to protect the circulatory system is to add a handful of unsalted nuts (especially walnuts and almonds) to basic meals or as a snack 4-5 times a week. Nuts are a rich source of polyunsaturated fatty acids omega 3, they also contain a large amount of magnesium, which has a positive effect on the circulatory system. It should be remembered, however, that the portion of nuts is very caloric (100 g provides over 600 kcal). It is also worth reaching for valuable pumpkin seeds or sunflower seed and adding them to dishes or eat as an appetiser.

One has to reduce or preferably eliminate the consumption of fatty meat products containing harmful for the circulation saturated fatty acids, such as: lard, bacon, greasy meats and meat, poultry skin and full-fat dairy products, including fatty yellow or processed cheese and cream. Animal fat should be replaced with vegetable oils - for frying rapeseed oil and olive oil and in salad linseed, rapeseed, soy bean, sunflower oil and olive oil. The recommended amount of fat is three servings (portion size: 1 teaspoon of vegetable oil or margarine, 1 tablespoon of low-fat mayonnaise) [4,5]

Fish (especially salt-water fish) should be the source of protein in the diet, as well as lean meat (eg poultry), lean dairy products (eg yoghurt and lean curds) and legume seeds (eg beans, peas and broad beans). The content of meat in the diet should be limited in favour of vegetarian dishes containing legume seeds (broad beans, chickpeas, soy beans, white and red beans) and various vegetables. At least twice a week, it is worth to consume oily salt-water fish containing beneficial for the cardiovascular system omega 3 fatty acids. Lean dairy products should be consumed in the amount of 2-3 portions per day (portion size: 1 glass of skimmed milk, 2 slices of white cheese, 1 cup of yoghurt).

It is necessary to limit the salt intake to 5 g, or a teaspoon per day. It should be remembered that this also includes salt derived from processed products such as cured meats, cured meats, smoked fish, cheese, salty sticks, chips, crackers, peanuts and salted crisps, bread, preserves, instant soups and marinades. Excess salt content in the diet leads to the risk of hypertension that can cause stroke. [15]

It is necessary to maintain normal body mass. It is helpful in decisively limiting or even eliminating sugar, sweet drinks, cookies and desserts from the diet.

It is worth trying to be physically active (housework, walking, swimming). Physical activity not only prevents hypertension but also helps in regulating the pressure when hypertension is already present. Also, daily physical exercise improves overall fitness and well-being. It is recommended to exercise moderately for 30 minutes per day. [4,5]

DASH diet in the light of EBM

The influence of dietary intervention on blood pressure in patients with normal and high blood pressure was the subject of clinical tests [6,7].

The Dietary Approaches to Stop Hypertension (DASH) study involved a diet that promoted the intake of vegetables, fruits and small amounts of dairy products, contained whole grain cereals, fish, poultry and nuts, while limiting the amount of red meat in the diet, sweetness and sweetened beverages.

Two types of dietary intervention were compared:

- fruit and vegetable diet (FV) and

– low-fat diet (DASH).

The latter one was designed to limit the total intake of saturated fat as well as cholesterol. In comparison to a typical diet used by the US residents, both types of dietary intervention caused a decrease in blood pressure.

The DASH diet more effectively reduced the systolic and diastolic blood pressure both in hypertensive patients and those with normal pressure values [80]. The study also showed that the DASH diet was effective as the first-line treatment in people with the first degree of hypertension (in people with blood pressure values of 140-159 mmHg / <90 mmHg).

In 78% of people using the DASH diet a decrease in systolic blood pressure below 140 mmHg was observed, whereas in the control group it was found in 24% of subjects [8].

The DASH diet caused the reduction in the concentration of cholesterol and LDL cholesterol in serum but there was also a decrease in HDL cholesterol [9]. The risk index according to the Framingham study was improved as a result of the reduction of total cholesterol and cholesterol. The effect of co-existing HDL cholesterol lowering should still be analysed.

A study was conducted after the DASH research combining the DASH diet with high, medium and low sodium content in the diet. In this intervention, the influence of the above-mentioned combinations on blood pressure was examined about the control group using the diet typical for the United States, administered with similarly graded sodium content [7].

In each of the studied groups (DASH compared to the "typical diet") participants within 30 consecutive days, randomly consumed food products with high, intermediate or low sodium content. The reduction of sodium intake caused a significant decrease in systolic and diastolic blood pressure in the group on the DASH diet, as well as in the control group.

The largest drop in blood pressure was observed in the group of patients in whom the sodium supply was reduced and who simultaneously followed the DASH diet. In comparison to the control group, the DASH diet with low sodium content led to an average reduction in blood pressure by 7.7 mmHg in non-hypertensive patients and by 11.5 mmHg in people diagnosed with hypertension.

Research also showed that diastolic blood pressure in people following the low-sodium DASH diet was 4.5 mmHg lower than in people who followed a traditional diet with high sodium content [7,8].

Following the low-sodium DASH diet is important in the strategy of prophylaxis and treatment of hypertension and related to that coronary heart disease, both at the population level and in dealing with individual patients.

Following the low-sodium DASH diet by large populations is likely to be a beneficial and safe method leading to lowering blood pressure and cholesterol in the population. Such a change would involve a lower global risk of cardiovascular disease.

At the same time, following this diet will be an effective, non-pharmacological treatment in people with a recognised increased risk of cardiovascular disease, resulting from high blood pressure and the presence of other risk factors [7,8].

#### Literature

1. Ciborowska H., Rudnicka A. *Dietetyka. Żywnienie zdrowego i chorego człowieka*. Wydawnictwo Lekarskie PZWL, Warszawa 2010;459-461.
2. Wiecek-Chełmińska B. *Żywnienie w chorobach serca*. Wydawnictwo Lekarskie PZWL, Warszawa 2003.
3. Cybulska B., Kłosiewicz-Latoszek L., Cichocka A. Zaburzenia lipidowe. *Medycyna Praktyczna* 2017;9:94-102.
4. Wolnicka K. *Instytut Żywności i Żywienia*.
5. <http://health.usnews.com/best-diet/best-diets-overall>, dostęp 10.01.2019.
6. Sacks FM, Svetkey LP, Vollmer WM et al. Effects on blood pressure of reduced dietary

- sodium and the Dietary Approaches to Stop Hypertension (DASH) diet. *N Engl J Med* 2001;344:3-10.
7. Appel LJ, Moore TJ, Obarzanek E et al. A clinical trial of the effects of dietary patterns on blood pressure. *N Engl J med* 1998;336:1117-24.
  8. Moore TJ, Conlin PR, Ard J, Svetkey LP for DASH Collaborative Research Group; DASH (Dietary Approaches to Stop Hypertension) Diet is Effective Treatment for Stage 1 Isolated Systolic Hypertension. *Hypertension* 2010; 38:155-8.
  9. Obarzanek E, Sacks FM, Vollmer WM et al. Effects on blood lipids of a blood pressure-lowering diet: the Dietary Approaches to Stop Hypertension (DASH) Trial. *AM J Nutr* 2001; 74:80-106.
  10. Januszkiewicz A, Więcek A, Hoffman P i inni. Nadciśnienie tętnicze. Współczesna diagnostyka i podstawy terapii. *Medycyna Praktyczna*, Kraków 2014; 3.6:33-36.
  11. Cutler JA, Psaty BM, MacMahon S, Furberg CD. Public health issues in hypertension control: what has been learned from clinical trials. In: Laragh JH, Brenner BM, eds. New York: Raven press, 2005.
  12. Cutler JA, Follman D, Allender PS. Randomized trials of sodium reduction: an overview, *AM J Clin Nutr* 1997;65:643S-51S.
  13. Whelton PK, He J, Cutler JA et al. Effects of oral potassium on blood pressure. Meta-analysis of randomized controlled clinical trials. *JAMA* 1997;277:1624-32.
  14. Salim Y, John A. Cairns, John C et al. Evidence-based Cardiology. *BMJ Books* 2003;398-400.
  15. Januszkiewicz W. Sznajderman M. Jak żyć z nadciśnieniem tętniczym. Wydawnictwo Lekarskie PZWL. Warszawa 2002;33,80.
  16. Hasik J, Gawęcki J. Żywnienie człowieka zdrowego i chorego. Tom 2. Wydawnictwo Naukowe PWN. Warszawa 2000;173.