**The Effect of Dietary Changes in Controlling the Hypertension**

**in Low-Income and Middle-Income Countries**

**Mahendro Prasetyo Kusumo1,2 Panji Tutut Anggraini3, titik hidayati2**

1 Master of Hospital Management, Postgraduate Program, Universitas Muhammadiyah Yogyakarta, Indonesia

2Department of Public Health and Family Medicine Faculty of Medicine and Health, Universitas Muhamadiyah Yogyakarta, Indonesia

3Runah Sakit Islam Faisal, Makasar Indonesia

**Abstract**

**Objective:** This study aims to know the effect of diet control education intervention against the behavior changes in controlling the blood pressure for hypertensive patients.

**Methods**: This study used the design of Quasi-experimental with pre-test and post-test with the control group. The group of intervention and control were chosen through the implemented criteria of inclusion and exclusion. The used sampling technique was a simple random sampling. There were 84 subjects of hypertensive patients. The group was divided into two groups, i.e., 42 patients (intervention group) and 42 patients (control group). The intervention was done for six weeks.

**Result:** There are differences in dietary control behavior changes between the control and intervention groups. The intervention group has significant (p<0,05) change, i.e., 1.41 while control group has decreased in score (∆) (0.47) where the value of p is not significant, i.e., (p>0.05). For systolic and diastolic blood pressure, the score of (∆). The average value of systolic blood pressure for the intervention group was 4.47 mmHg/5.17 mmHg, and the increase of the average value of systolic blood pressure was 3.63 mmHg/5.95 mmHg for the control group.

**Conclusion:** There is the influence of dietary control education on blood pressure control for hypertensive patients.

**Keywords:** Hypertension, dietary control, education

**Introduction**

In 2012, the World Health Organization (WHO) reported that the global prevalence of hypertension is approximately 972 million people (26.4%) of the total world population. In the developed country, there are 333 million people, and in the developing country, there are 639 million people including Indonesia. This prevalence is predicted to continue up to increase to 29.2% in 2030 (WHO, 2012). Hypertension is one of the chronic diseases which is the most significant cause of death. Most of the complications that cause these deaths are cardiovascular. Nine million people die each year due to these complications *(*Kishore *et al*.,2016).

According to Clinical Practice Guideline, management of hypertension is divided into two namely pharmacology and nonpharmacologic. The pharmacological management consists of medicine distribution which is diuretic, sympathetic, beta blockers and vasodilators. At the same time, non-pharmacologically treatment focuses on the control of dietary by using DASH (Dietary Approach to Stop Hypertension) and routine exercise (McConnell & Baker, 2013).

Dietary control in one component of lifestyle change that has a role in controlling the blood pressure (Kumala, 2014). Dietary control provides the benefits in decreasing the level of progression and cardiovascular risk factors including hypertension. Knowledge, characteristic and behavior are the essential component for the success of the control of hypertension (Zaini *et al*., 2015). Dietary control is recommended for controlling weight (Johnson *et al*., 2015).

**Methods**

This study used the Quasi-experimental design with pre-test and post-test with the control group. The intervention group is the group that receiving an intervention while the control group is the group that does not receive an intervention. The sample was chosen through specified inclusion and exclusion criteria. The technique of sample selection was using simple random sampling. Both groups answer the questioner from the researcher then, the intervention group will obey the program of dietary control which consisting of group counseling with a frequency of once for six weeks for duration of 30-45 minutes, filling the independent control cards, watching video playback about dietary control and hypertension for 3-5 minutes, personal education with a frequency of twice a week for six weeks.

The independent control card was filled in by the respondent if there were complaints outside the researchers' follow-up time. After six weeks, the researcher conducted the assessment based on the patient answers to the questionnaire and the result of the blood pressure test. The used instruments were the questionnaire for measuring patient behavior that has been validated, blood pressure measurements using a sphygmomanometer that has been calibrated before and the guidelines for dietary control activities.

**Result**

The research was carried out in Sleman Regency for six weeks from September to November 2017. This study was using 84 samples that were divided into two groups, i.e., 42 samples in the intervention group and 42 samples in the control group. The researcher conducted the preliminary assessment to know whether the condition of both groups has similarities or differences after receiving the dietary control intervention.

The result of the preliminary research shows that the preliminary data comparison test (baseline) between the control and intervention group has no significant differences (p>0.05) (Table 1).

Table 1. The Characteristic of Preliminary Data of Respondent before Receiving the Intervention

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **No** | **Pre-Data** | **Control** | **CI** | **Intervention** | **CI** | **p** |
| **1** | **Average Score of Diet Behavior** | 6.30±0.89 | 6.03-6.58 | 6.59± 1.16 | 6.23-6.95 | 0,191 |
| **2** | **Average Score of Systolic Blood Pressure** | 154.23±9.07 | 1.51-1.57 | 152.95±8.82 | 1.50-1.55 | 0,435 |
| **3** | **Average Score of Diastolic Blood Pressure** | 89.28±8.37 | 86.67-91 | 92.14±5.64 | 90.38-93.9 | 0,068 |

Description: p is the significance value between the control group compared to the intervention group (p <0.05)

The result of research after applying of dietary control intervention for six weeks shows that the average score of the control group was decreasing from 6.30 to 5.83 with p 0.414. It means H0 was accepted or there were no differences in dietary behavior in the control group. For the intervention group, the average score of dietary behavior was increasing from 6.59 to 8.00 with p 0.00. Thus, H0 was rejected, or there were differences in dietary behavior in the intervention group.

The result of research after implementing the intervention for six weeks and carrying out the blood pressure test for three times a week shows that the average of systolic blood pressure after intervention in the control group was increasing from 89.28 to 157.86 (p 0.000). This result indicates that there was a significant difference in systolic blood pressure average. At the same time, for the intervention group, the average systolic blood pressure was decreasing from 152.95 to 148.48 (p 0.001). It means that there was a significant difference in the systolic blood pressure average in the intervention group.

Meanwhile, the diastolic blood pressure in the control group was increasing from 89.28 to 95.23 (p 0.000). Thus, there was a significant difference in the diastolic blood pressure average. Also, for the intervention group, the average of diastolic blood pressure was decreasing from 92.14 to 86.97 with (p 0.000). It means, there was a significant difference in the average of diastolic blood pressure.

**Table 3. The Characteristic of Respondent Data after Intervention**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| No | Post Data | Mean±SD (95% CI) | p | ∆ |
| ControlGroup | InterventionGroup |
| *Mean* | CI | *Mean* | CI | p1 | p2 | p3 | ∆1 | ∆2 |
| **1** | **Average diet behavior score** | 5.83±0,62 | 5.63-6.02 | 8.00±0.62 | 7.80-8.19 | 0,414 | 0,00 | 0,000 | 0,47 | 1,41 |
| **3** | **Average Score of Systolic Blood Pressure** | 157.86±7.58 | 1.55-1.60 | 148.48±6.48 | 1.46-1.50 | 0,000 | 0,001 | 0,000 | 3,63 | 4,47 |
| **4** | **Average Score of Diastolic Blood Pressure** | 95.23±4.93 | 93.70-96.77 | 86.97±4.94 | 85.03-88.51 | 0,000 | 0,000 | 0,000 | 5,95 | 5,17 |

Description: p is a significance value; p1 is the significance value between pre and post of the control group (p <0.05); p2 is the significance value between pre and post of the intervention group (p <0.05); p3 is the significance value between the post-post of the control group and the intervention (p <0.05); Δ = change in score. Δ1 = change in score of the control group; Δ2 = change in score of the intervention group

**Discussion**

### Pathophysiology of Hypertension

Hypertension is one of chronic disease that becomes global health problems in both developed and developing countries. This disease is the This disease is the biggest risk factor for cardiovascular death, which is more than 40% of the population over the age of 25 years and is estimated to cause as many as millions of deaths every year (Kishore *et al*.,2016). According to the World Health Organization (WHO) in 2012, the global prevalence of hypertension was 972 million (26.4%) of the total population which divided into two, i.e., in developed countries approx. 333 million and in developing countries approx. 639 million, including Indonesia. This number is predicted to continue to increase to 29.2% in 2030 (WHO, 2012).

Hypertension is a systemic disease that can cause various complications, such as stroke, heart disease, congestive heart disease, AMI (Acute Myocard Infarction), chronic renal failure, etc. (Williams, 2015). The management of this disease was done according to Clinical Practice Guideline. The management of hypertension is divided into two, i.e., pharmacology and non-pharmacology. The pharmacology management consists of medicine distribution that are diuretic, sympathetic, beta blocker and vasodilator. Non-pharmacological treatments include weight loss or normal weight maintenance, regular exercise, low salt & fat diets, DASH (Dietary Approach to Stop Hypertension) and smoking cessation (McConnell & Baker, 2013). The change of lifestyle is part of the hypertension management that can be utilized for decreasing the blood pressure, increasing the effectiveness of antihypertensive drugs, and decreasing the risk of cardiovascular. The modify of dietary control is one of one component of lifestyle changes that has the most significant role in reducing blood pressure (Kumala, 2014).

1. **JNC VIII Recommendation**

The recommendation of JNC VII is about limiting the consumption of salt no more than 2.4 grams of sodium or about one teaspoon of salt. Based on the research of Appel & Lawrence (2003), the recommendation mentioned before can decrease the systolic blood pressure for approx. 2.8 mmHg. The research of Soltani (2016) shows that the comparison of lifestyle recommendations (ELR), socialization, DASH counseling and also salt restriction <2400 gr a day decreases the blood pressure for approx. 32%. It is higher than the group that applies ELR only (Soltani et al., 2016).

Sodium is the primary component that contributes to the changes in the extracellular fluid. The increase in sodium in the blood will cause an increase in sodium reabsorption. It is because there is an increase in the osmotic pressure of the interstitial fluid and a decrease in the hydrostatic pressure of the interstitial fluid. This mechanism causes increased total peripheral resistance and cardiac output. As a consequence, the blood pressure increases. The mechanism of the association of increasing sodium consumption results in significant systolic blood pressure has been proved by Takase (2015) who investigated that an increase in the amount of sodium in urine that is accommodated in 24 hours is associated with the increased blood pressure in Japan population (Takase et al., 2015).

1. **Body Mass Index (BMI)**

Body Mass Index (BMI) is the result of weight in kilograms (Kg) divided by height in meters squared (m2). BMI is used to assess the proportionality of the ratio between one's height and weight. BMI is used to measure ideal weight and is a good measurement method to assess the risk of diseases that can occur due to excessive body weight including hypertension (CDC, 2009). Hypertension patient is recommended to have BMI in the range of 18.5–24.9. The patients who have normal BMI criteria are suggested to maintain and for the patients who have over BMI criteria are recommended to decrease it. A decrease in BMI in this range will reduce blood pressure by approx. 5-20 mmHg or 10 kg of weight loss.

### Theory of behavior change to improve self-care

This treatment concept is the derivative of the SCT theory that focuses on the final purpose of the patients (Riekert et al., 2014). This final purpose is the success of the patients in controlling the complications and becoming the role model for the other patients who have not succeeded in controlling complications (Sulaeman, 2016). The model of self-care treatment describes that when the patients were taking self-care actions, it was influenced by internal and external factors. The patient's knowledge, attitudes, feelings, and beliefs are internal factors that greatly influence self-care. In addition to internal factors, external factors which consist of role models, technical advice and service, social support, cost sources, and health facility systems also play an important role in the success of self-care (Riekert et al., 2014).

Three main factors that support the theory of HBM are the factor of modification (knowledge), factor of sociodemographic (which can affect the perception of health), factor of health beliefs. The higher the belief/vulnerability of DM patients about the possibility of getting a complication (perceived susceptibility), the higher healthy behavior that will be carried out (Salazar et al., 2015).

### DASH (Dietary Approach To Stop Hypertension)

The management of DASH is suggested by JNC VII for hypertension management. Principally, this dietary control let the patients consume the fruits, vegetables, low-fat milk, and nuts. This dietary contains potassium level. Thus, for patients with decreased kidney function need to be reconsidered to implement this dietary. Sodium recommended is <2.4 g (100 mEq) / day (National Institute of Health, 2003)**.**

Obese hypertensive patients have a characteristic increase in cardiac output, stroke and intravascular volume, which has a close correlation with fat-free body mass compared to adipose mass. Increasing the amount of adipose in obese patients will increase the production of substances that will cause insulin resistance. Obesity is also commonly known has relation to the circulating hyperleptinemia. Leptin will directly decrease arterial distensibility, it affects tone and the growth of blood vessel, and stimulates proliferation of vascular smooth muscle cells. All of these will increase blood pressure (hypertension) (Eikelis *et al.,*2003).

1. **Dietary Control Program for Hypertensive Patients**

United States Department of Agriculture (USDA) issued the graph on a food guide called “MyPyramid” to motivate the patients in consuming healthy food. The graph is equipped with the interactive online system that can propose a suggestion about dietary and specific diet and physical activity that is tailored to the needs of each user. MyPyramid tends to improve diet and carry out physical activities independently. The Food Guide Pyramid categorizes five groups of food, i.e., cereals/oats, vegetables, fruit, milk products, and protein-rich foods. Cereals/wheat are at the bottom of the pyramid to indicate the largest portion of food. Fat, oil, and sugar are at the top of the pyramid, to suggest that these foods must be consumed carefully. Everyone consumes at least 1600 kcal per day and at most 2800 kcal per day.

In addition to my pyramid method, patients can choose a more practical method of eating control, namely "My Plate." This method is an application in the form of an internet-based graph that can be applied using a computer. The aim of the MyPlate method is as a reminder to choose healthy foods, emphasizing the intake of vegetables and fruits. My Plate provides different meal plans and sample menus. These differences are made because considering the differences in age, gender, height, weight, and physical activity. For example, a 40-year-old woman, 66 inches tall, and 135 pounds weighs who does 30-60 minutes of moderate physical activity in a day, estimated to need 2200 calories per day.

In the end of research, after the diet control package approach, which included class counseling with a frequency of 1x / 6 weeks for 6 weeks duration of 30-45 minutes, self-control card, dietary control and hypertension video for duration of 3-5 minutes, personal education with flip-flops with 2x frequency / week for 6 weeks, it can be seen that there is a difference in dietary behavior change in the control and intervention group. It can be seen in Table 3. From the change of dietary behavior level (∆) score between control and intervention group, it is known that there is a significant difference (p<0,05) in intervention group which is marked by the increasing the dietary behavior level (∆) score in the intervention group (1.41). Meanwhile, in the control group, there is decreasing dietary behavior level (∆) score in the control group (0.47) with a non-significant difference in p-value (p>0.05).

Lifestyle modification (LSM) is the recommendation from Joint National Committee VIII to be done by hypertensive sufferers. In the JNC VIII guideline, LSM that is recommended is DASH (Dietary Approaches to Stop Hypertension), weight loss or maintenance healthy weight, and reduced sodium intake, physical activity, alcohol restrictions and smoking cessation (Blumenthal et al., 2016).

The result of this research is supported by the study of Stoutenberg & Stanzilis at al (2014) which concludes that there is increasing in dietary behavior level, physical activities and decreasing in the value of total cholesterol, triglycerides, HbA1c and fasting glucose after LMP (Lifestyle Modification Program). LSM contains the activity program of education, counseling for patients for 1-4 months (Stoutenberg & Stanzilis, 2014). The result of the other studies also shows that by increasing self-care and motivation trigger the increase in dietary control of patients (Simmons & Wolever, 2013). The researcher also argues that the increase of the intensity of the dietary control behavior in patients is closely related to the strong motivation of the patient to recover from his illness. This thing can be proved by increasing dietary control for hypertensive patients. (James et al., 2014). Motivation is a primary factor that can promote and trigger the rise of spirit and also able to change individual behavior to be better (Hardcastle, 2015).

As mentioned in table 6, some patients in the control group also implement the behavior change. However, it is not as much as in the intervention group. Even, it can be seen that there is a decrease in score on the level of dietary behavior in the control group. This thing is caused by the patients in the control group did not receive the information about the benefits of dietary control on blood pressure control, also, the counseling from doctors and nutritionists. The change of behaviors that occurs on patients of the control group is caused by the pressure to obey the order of doctor, or the patients get influence from other media that cannot be controlled by researchers. It can be seen that the approach of dietary control has a significant effect against the change of dietary control behaviors.

Motivation and level of compliance of respondents can be obtained through a lot of ways, among others are counseling, group discussion, interview, debriefing, learning media like video, role play, etc. These motivations lead to the rise of knowledge. In this term, the knowledge is the knowledge of the patients toward their illness, its management, its prevention, etc. The patients who have a standard level of expertise on hypertension will be motivated to obey the guideline of dietary control (Klarenbeek, 2015).

The research result of Thompson (2014) stated that there is a relationship between someone's knowledge and their attitude towards the treatment they are undergoing. The knowledge will form someone’s framework of thinking that relates to the self-management undertaken. This thing shows the importance of knowing the illness affects the success of medication. (Thompson, 2014).

The researcher carried out the pre-test before the intervention in order to prevent the coincidence bias. The result of the test before intervention for both groups shows that there is no significant difference in systolic and diastolic blood pressure (p>0,05). At the end of research, after implementing the intervention, the differences in mean systolic and diastolic blood pressure occurs. This thing is supported by some other research which mentions that the intervention of Lifestyle Modification Programme (LMP) that contains counseling, education, brainstorming about hypertension and LMP in seven weeks decreases the systolic and diastolic blood pressure and increases the knowledge on hypertension with a significant p (p<0.005). A study of 27 RCTs noted that increasing physical activity three times a week for 30 minutes reduced systolic blood pressure (TDS) and also facilitated weight loss (Appel, 2003).

Research in Indonesia compares the implementation of DASH that is combined with a reduction in salt consumption and the implementation of a low salt diet in menopausal women with hypertension. The result shows that the combination of DASH with a reduction in salt consumption decreases the average of systolic and diastolic blood pressure for 5.23 mmHg dan 1.98 mmHg. Meanwhile, a low salt diet can reduce the average of systolic and diastolic blood pressure for 2.5 mmHg dan 1.75 mmHg (Rahmayanti & Sutjiati, 2009).

DASH consists of consumption of food ingredients that are clinically proven to significantly reduce blood pressure with or without a reduction in sodium intake (Trial et al., 2015). Food items contained in the DASH are cereals and whole grains as many as 7-8 exchanges per day, vegetables as much as 4-5 exchanges per day, fruits 4-5 exchanges per day, low or no fat dairy products 2-3 exchanges per day, fish, meat and poultry no more than 2 exchanges per day, 4-5 exchanger nuts per week, 2-3 oil exchangers a day and 5 sweeteners per week sweetener (Pennington Centre, 2014).

According to McFall&Barkley (2010), the implementation of DASH consists of the consumption of low sodium food, high in potassium, magnesium, calcium, fiber, and also low in saturated fatty acids and cholesterol clinically proven to reduce blood pressure significantly with or without a reduction in sodium intake. The research of Padma (2014) stated that DASH could decrease the systolic blood pressure of 8 mmHg and diastolic blood pressure of 3 mmHg in two weeks.

**Conclusion**

Based on the results of the study, it was concluded that there were effects of dietary control interventions to change behavior in controlling blood pressure in hypertensive patients.

**Authors’ contributions:**

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