Correlation of Sodium Intake, Body Mass and Physical Activity with Blood Pressure

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Abstract: Hypertension is the biggest disease suffered by the Indonesian population. Hypertension is a condition in which the systolic blood pressure increases more than 140 mmHg or diastolic more than 90 mmHg on two measurements with an interval of five minutes in a state of sufficient rest or calm, the normal limit of blood pressure is less than or equal to 120 mmHg. Based on several research results, it is known that blood pressure is strongly influenced by activity factors, excessive salt consumption, and other factors. The purpose of this study was to determine the relationship between physical activity, sodium intake and body mass index with blood pressure in outpatients at the Puskesmas Tirawuta, East Kolaka Regency.This type of research is an observational analytic with a Cross Sectional Study approach. The sample in this study were all 37 outpatients aged 18 years at the Tirawuta Public Health Center in April 2022 and tested using Chi-square with a 95% confidence level. Based on the results of the study, it was found that most of the physical activity samples (56.8%) had light physical activity, most of the sample's sodium intake (62.2%) had more sodium intake, while the sample BMI (51.4%) had more body weight. Statistical tests showed that there was a relationship between physical activity and blood pressure, as well as a relationship between sodium intake and blood pressure, while in the BMI variable there was no significant relationship between BMI and blood pressure.

Keywords: Blood Pressure; BMI; Physical Activity; Sodium Intake

Introduction

State Over the past two decades, there has been a significant epidemiological transition, with non-communicable diseases becoming a major burden, in addition to communicable diseases. Thus, Indonesia is experiencing a double burden of disease, namely non-communicable diseases and infectious diseases. Major non-communicable diseases include hypertension, diabetes mellitus, and cancer (Herzallah et al., 2019; Ouyang et al., 2022).

High blood pressure is a worldwide health problem. Based on data from the World Health Organization (WHO) in 2013, there was an increase in the number of people suffering from hypertension from 600 million in 1980 to 1 billion in 2008 (Kasaudhan et al., 2022). It is estimated that it will continue to increase in 2020 around 1.56 billion adults will live with

hypertension, and every year 9.4 million people die from hypertension and its complications (Kemenkes, 2014).

In Indonesia, the prevalence of hypertension has increased and fluctuates every year. The prevalence of hypertension aged >18 years in 2007 was 31.7%, then decreased in 2013 which amounted to 25.8%, and the results of basic health research (RISKESDAS) 2018 hypertension prevalence rate increased again to 34.1%. In this research, information was also obtained that the prevalence of hypertension in the elderly age group had a high increase in cases. In the age group 55-64 years old, it was 55.2%, in the group 65-74 years old it was 63.2%, in the age group 75 and above it was 69.5% (Kemenkes, 2018).

In Southeast Sulawesi Province in 2017, hypertension ranked second in the category of the top 10 (ten) diseases with 11,625 cases and in the category of non-communicable diseases (NCDs) ranked first with a

percentage of cases of 33.68%. Based on gender, hypertension is found more in men, namely 45.61%, compared to 30.21% in women. In 2018, patients with hypertension who were provided with health services amounted to 81,126 (19.87%) consisting of 24,285 men (13.47%) and 57,141 women (24.89%).

One of the districts in Southeast Sulawesi with a high prevalence of hypertension is East Kolaka. In 2019 and 2020 hypertension ranks first in the number of sufferers for non-communicable diseases, and the number of sufferers has increased from 2019 (1840 cases), and 2020 (4506 cases). From a number of health centers in East Kolaka (12 health centers), the health center that reported the most cases from 2019 to 2020 was Tirawuta Health Center. In 2019 there were 449 cases (37 people/month), and in 2020 there were 309 cases (25 people/month).

There are two risk factors for hypertension, namely factors that cannot be controlled and factors that can be controlled (Asiri et al., 2020). Uncontrollable risk factors include genetics and individual characteristics such as age, gender, and race (Balwan & Kour, 2021) while controllable risk factors include obesity, stress and behavior or lifestyle such as lack of activity and food consumption (sodium and fat intake) (Maharani et al., 2022). There are several factors that cause a person to develop hypertension, including age, gender and ethnicity. In addition, there are also genetic factors and environmental factors such as obesity, stress, salt consumption, smoking, alcohol consumption and so on (Anggara & Prayitno, 2013).

Lack of physical activity increases the risk of suffering from hypertension. Inactive people tend to have a higher heart rate frequency so that the heart muscle has to work harder with each contraction, the bigger and more often the heart muscle pumps, the greater the pressure on the arteries so that blood pressure will increase (Anggara & Prayitno, 2013). Research conducted by Muliyati et al. (2011) in the journal of the relationship between sodium and potassium consumption patterns and physical activity with the incidence of hypertension at DR. Wahidin Sudirohusodo Hospital Makassar shows that there is a relationship between physical activity and hypertension. Respondents as much as 64.4% had mild activity suffering from hypertension, while 35.6% of respondents who had moderate activity did not suffer from hypertension.

Excess sodium intake can be a contributing factor to hypertension because sodium has the property of retaining water, so if you consume excessive sodium, it can cause blood pressure to increase. Sodium is associated with the incidence of high blood pressure because the consumption of high amounts of sodium can shrink the diameter of the arteries, so the heart must pump harder to push the increased blood volume

through a narrower space and will cause blood pressure to increase (Kautsar et al., 2014). The results of research conducted by (Fitriana, 2015) which showed a significant relationship between the level of sodium consumption and hypertension in the elderly with a p value of 0.000. Similar research conducted by (Siregar & Lubis, 2015) shows that there is a significant relationship between sodium intake and the incidence of hypertension with a p value of 0.005.

Body Mass Index (BMI) is a simple tool or way to monitor the nutritional status of adults, especially with regard to underweight and overweight (Supariasa et al., 2016). Research conducted by Fathina (2007), namely, the relationship between fat source intake and body mass index with blood pressure in hypertensive patients, of the 40 respondents studied, Body Mass Index (BMI) has a significant relationship with systolic (p = 0.00) and diastolic (p = 0.00).

Based on the above thoughts, researchers are interested in conducting a study on the relationship between physical activity, sodium consumption patterns and body mass index with blood pressure in outpatients at Tirawuta Health Center, East Kolaka District.

Method

This study is an observational analytic with a Cross Sectional Study approach, and analyzed categorically analytically, namely a design design where the required variable data is taken at the same time. This research was conducted in April 2022 at the Tirawuta Health Center, East Kolaka Regency. All outpatients aged ≥18 years at the Tirawuta Health Center in the month of the study as many as 37 samples. All outpatients aged ≥18 years in April 2022 were 37 samples (total sampling).

Inclusion criteria

All outpatients ≥18 years old who are registered at UPTD Puskesmas Tirawuta, can communicate well, the sample lives in the working area of the UPTD Puskesmas Tirawuta, and Willing to participate in the study. Data on the characteristics of the sample name, age, gender were obtained through interviews using a questionnaire. Blood pressure data obtained from the results of blood pressure measurements at the time of the study. Physical activity data was collected by interview method using a questionnaire instrument recall activities for 24 hours of physical activity performed and expressed in Physical Activity Level (PAL) or physical activity level. Sodium intake data was obtained by interview method using 2x24 hours consecutive food recall questionnaire. BMI data was measured using body weight weighing (digital scales) and height measurement (stature meter), which was then entered into the formula = BW (kg) / TB (m)^2.

Secondary data was obtained through a documentation approach, namely recording existing data at the puskesmas that was needed and relevant to this study, including general description of the research location (puskesmas), obtained through recording in the puskesmas profile book. Physical activity data was obtained from interviews using a 24-hour activity recall questionnaire and calculated using the physical activity score calculation formula, namely: PAL = (PAR) x (W) / 24 hours. Furthermore, it was categorized according to the PAL score criteria: (a) Mild: 1.40 - 1.69 kcal/hour, (b) Moderate: 1.70 - 1.99 kcal/hour.

Sodium intake data was obtained from a 2x24 hour recall form in the form of household size (URT), then entered into the nutri survey program so as to obtain the sodium intake of the sample per day. Furthermore, the results of the first- and second-day recall were summed up to get the results of sodium intake in 2x24 hours. Furthermore, it is categorized according to objective criteria: a) Adequate: if sodium intake (≤2400 mgNa / day), b) More: if sodium intake (>2400 mgNa/day)

BMI data is obtained from the measurement of the respondent's weight and height. After obtaining the weighing results then entered into the formula: BMI = Body Weight (kg)/(Height (m))^2. Next categorized according to objective criteria: a) Normal: if BMI is 18.5 - 24.9, b) Overweight: if BMI >25.

Blood pressure is obtained from measurements using a tensimeter measuring instrument, then categorized according to objective criteria: a) Normal: if ≤120/80 mmHg, b) Hypertension: if >130/80 mmHg.

Univariate analysis was used to describe the research variables, namely physical activity, sodium intake and BMI presented in the form of tables and narratives. Bivariate analysis was conducted to determine the relationship between the independent variables (physical activity, sodium intake, BMI) and the dependent variable (Blood Pressure) using the Chi-square test with a 95% confidence level and using a computer.

Interpretation of the level of significance (significant) of the statistical test results p there is a two-sided hypothesis i.e Ha accepted if the p value is <0.05, which means that there is a relationship between the independent variable (free) and the dependent variable (bound). Ha is rejected if the p value> 0.05, which means that there is no relationship between the independent variable (free) and the dependent variable (bound).

Result and Discussion

Relationship between Physical Activity and Blood Pressure

The results of the study showed that 56.8% of the sample had mild physical activity suffering from hypertension, while 43.2% of the sample had moderate physical activity not suffering from hypertension. And obtained a value of p=0.000 (<0.05) which means there is a significant relationship between physical activity and blood pressure.

This study is in line with research conducted by Paruntu et al. (2015), namely there is a significant relationship between physical activity and blood pressure where p value = 0.000. In addition, research conducted by Muliyati et al. (2011) in the journal of the relationship between sodium and potassium consumption patterns and physical activity with the incidence of hypertension at DR. Wahidin Sudirohusodo Makassar Hospital also shows that there is a relationship between physical activity and hypertension. Respondents as much as 64.4% had mild activity suffering from hypertension, while 35.6% of respondents who had moderate activity did not suffer from hypertension.

Based on the results of a survey using physical activity recall, it is known that only a small proportion of the sample has heavy physical activities such as farming, while more physical activities are done, namely cleaning the house, cooking and watching television. Light activity can increase heart rate and increase blood pressure, causing hypertension. The sample's lack of physical activity is due to age factors that are classified as elderly. Physical activity is very important, especially for the elderly, by doing physical activity, the elderly can maintain and even improve their health status. However, due to the physical limitations that the elderly have due to age and changes and decreases in physiological functions, the elderly need several adjustments in carrying out daily physical activity (Fatimah, 2010)

A person with less physical activity has a 30-50% tendency to develop hypertension than those who are active. Increasing the intensity of physical activity, 30-45 minutes per day, is important as a strategy for the prevention and management of hypertension. Physical activity that can burn 800-1000 calories will increase High Density Lipoprotein (HDL) by 4.4 mmHg (Santoso & Rusjiyanto, 2013).

Relationship between Sodium Intake and Blood Pressure

Based on the results of the study, it was found that samples with high blood pressure (hypertension) mostly (62.2%) had more sodium intake, while samples with normal blood pressure were small (37.8%) had sodium intake in the sufficient category. After being tested using chi-square, the p value = 0.000 (<0.05) was obtained, so it can be concluded that there is a significant relationship between sodium intake and blood pressure.

The results of this study are in line with research conducted by Susanti et al. (2017) with a value of p=0.040 showing the results that p,0.05 which means there is a relationship between sodium intake and systolic blood pressure. Meanwhile, according to (Fitri et al., 2018)

there is a significant relationship between sodium intake and the incidence of hypertension with a value of p=0.000.

The effect of sodium intake on the occurrence of hypertension through increased plasma volume and blood pressure. People who consume small amounts of salt have been shown to have a lower history of hypertension. The habit of consuming salty foods has a risk of suffering from hypertension by 3-9 times compared to people who do not have the habit of consuming salty foods.

Based on the results of a food consumption survey using 2x24 hour food recall, it is known that the most frequently consumed sodium source foods are salted and santa fish, the average sample consumes 4-6 times a week which is used as a side dish for daily meals. In addition, the eating habits of the elderly who consume more foods that are high in sodium such as instant noodles, snacks such as siomay, meatballs which can trigger high sodium intake. High intake of foods that contain high sodium can cause hypertension.

Excess sodium consumption can be a contributing factor to hypertension because sodium has the property of retaining water, so if you consume excessive sodium, it can cause blood pressure to increase. High sodium intake can cause an increase in plasma volume, cardiac output and blood pressure. Sodium causes the body to retain water at levels exceeding the body's normal threshold so that it can increase blood volume and high blood pressure.

High sodium intake causes hypertrophy of adipocyte cells due to the lipogenic process in white fat tissue (Fonseca-Alaniz et al., 2007; Tran et al., 2019), if it continues, it will cause narrowing of the blood vessel channel by fat and result in increased blood pressure. In addition to this, overweight and obese individuals are likely to have salt sensitivity which affects blood pressure (Kautsar et al., 2014).

Overweight and obese individuals are likely to have salt sensitivity that affects blood pressure. Salt sensitivity is a condition in which a person easily experiences an increase in blood pressure by consuming foods high in sodium (a form of salt) and a way to lower blood pressure by reducing salt intake. Salt causes fluid accumulation in the body because it attracts fluid outside the cells so that it does not release, thus increasing blood volume and pressure. In about 60% of cases of primary (essential) hypertension there is a response to lower blood pressure by reducing salt intake by 3 grams or less, the average blood pressure is found to be low, while in the community salt intake of about 7-8 grams the average pressure is higher. The regulation of sodium balance in the blood is regulated by the kidneys. The main source of sodium is table salt or NaCl (Komalasari, 2022).

Relationship between BMI and Blood Pressure

Based on the results of the study, it is known that samples with high blood pressure (hypertension) most (51.4%) have more weight, while samples with normal blood pressure most (48.6%) have normal weight. After being tested using chi-square, the value of p=0.091 (>0.05) was obtained, so it can be concluded that there is no significant relationship between BMI and blood pressure.

This study is in accordance with the results of other studies conducted in Samosir Village in 2016 by Arifin et al. (2016) using the chi-square method obtained that the p value was 0.160 where p> 0.05 which means there is no significant relationship between nutritional status and the incidence of hypertension.

Different results with other studies conducted at DR Moewardi Surakarta Hospital in 2017 by (Anggrah et al., 2017) using the chi-square test found that the p value was 0.000 with a p value <0.05 which means there is a relationship between BMI and the incidence of hypertension.

If the higher body mass index is a factor related to the pathogenesis of hypertension, but in this study, it produces a relationship that is not meaningful. For more information about the relationship between hypertension and body mass index, we can look at other factors associated with hypertension such as lifestyle, salt intake, physical activity, genetics and stress.

According to research obesity is one of the factors of hypertension. When a person is obese or in other words has excess weight, the person will need more blood to supply oxygen and food to his body tissues, so that the volume of blood circulating through the blood vessels increases, cardiac output also increases, and finally blood pressure also increases.

Conclusion

Sodium intake of the sample is mostly (62.2%) in the more category. There is a relationship between physical activity and blood pressure p value = 0.00. There is a relationship between sodium intake and blood pressure p value = 0.00. There is no relationship between BMI and blood pressure p value = 0.091. The light physical activity and excessive sodium intake are triggers for hypertension. In order for blood pressure to be well controlled, it is recommended to maintain physical activity such as regular exercise, do a lot of activities and reduce excess sodium intake such as canned food, salted fish, snacks such as fried dumplings, reduce salt levels in the cooking process and get used to consuming vegetables and fruit.

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