MINH
MALAHAYATI INTERNATIONAL JOURNAL OF NURSING AND HEALTH SCIENCE
ISSN 2620-9152 (Print)
ISSN 2621-4083 (Online)
DOI: 10.33024
Nomor: 79/E/KPT/2023

ARTICLE INFORMATION
Received: August, 30, 2024
Revised: September, 30, 2024
Available online: October, 01, 2024
at : https://ejurnal.malahayati.ac.id/index.php/minh

Body mass index (BMI) and genetic factors that predispose associated with the incidence of hypertension

Istiana Annisa*, Hadits Lissentiya Armal, Rian Bayu Santya Mahardhika

Politeknik Kesehatan Kementerian Kesehatan Banten
Corresponding author. *E-mail: istiana.annisa.job@gmail.com

Abstract

Background: Hypertension is a very dangerous non-communicable disease (NCD) (Silent Killer). Body mass index (BMI) is a measuring tool for monitoring adult nutritional status related to a person's body weight. Genetic is the science that studies the inheritance of traits (heredity) in organism.
Purpose: To determine the relationship between body mass index and genetic factors with hypertension.
Method: A cross sectional approach, specially focusing on a descriptive quantitative. Participants were selected using purposive sampling and the Slovin formula, resulting in 100 participants from Girang Community Health Center. Univariate statistical analysis was conducted, including a chi square and multiple logistic regression.
Results: Show a significance ($p < 0.05$) it means there is a relationship between body mass index and genetic with hypertension. The genetic variable that is most related to the incidence of hypertension is genetics with an odds ratio value of 3.441, meaning that respondents who have genetic hypertension have a 3.4 times chance of experiencing hypertension compared to respondents who do not have genetic hypertension. Meanwhile, the BMI variable has an odds ratio value of 1.903, meaning that respondents who have an abnormal BMI have a 1.9 times chance of experiencing hypertension compared to respondents who have a normal BMI.
Conclusion: There is a relationship between Body Mass Index (BMI) and genetic with the incidence of hypertension.

Keywords: Body Mass Index; Genetic; Hypertension.

INTRODUCTION

Hypertension is a condition medical condition where blood pressure gradually increases and causes the work of the heart becomes difficult. Hypertension is a very dangerous non-communicable disease (NCD) (Silent Killer). The definition of hypertension itself is a condition where there is an increase in systolic blood pressure reaching a figure above equal to 140 mmHg and diastolic above equal to 90 mmHg. Based on the cause, one type of hypertension is essential hypertension. Essential hypertension or primary hypertension of unknown cause, is also called idiopathic hypertension (Yhuwono, 2018).

A high and uncontrolled increase in blood pressure can make the heart and blood vessels experience excessive tension. The stress on the heart and blood vessels can increase the risk of heart attack or stroke and several other diseases. One of the risk factors for hypertension is obesity. Some risk factors that can cause hypertension are modern lifestyle habits such as consuming foods high in fat, high in calories, cholesterol and lack of physical activity (Rahmadhani, 2021). Risk factors are of two types which one controllable factors such as genetics, age and gender, along with modifiable factors such as lack of physical activity, alcohol consumption, smoking, diet, stress, excess salt

DOI: https://doi.org/10.33024/minh.v7i7.621

intake and obesity (BMI>25) (Lestari, Yulianti, & Tebesi, 2022).

Based on the 2021 World Health Organization (WHO) report, the number of people aged 30-79 years with hypertension has increased from 650 million people to 1.28 billion people in the last 30 years and almost half of them do not know that they suffer from hypertension. Basic Health Research in 2018 reported 34.1% rate of hypertension in people over 18 years of age. It was 31.6% in the 31-44 year age group, 45.3% in the 45-54 year age group, and 55.2% in the 55-64 year age group. Of the 34.1% of people with hypertension, only 8.8% of people diagnosed with hypertension, 13.3% of people diagnosed with hypertension do not take medication, and 32.3% of people who suffer from hypertension do not take medication regularly. This shows that there are still many hypertension sufferers who have not received the treatment they should get. The prevalence rate of hypertension in Banten Province in 2018 is still quite high compared to the prevalence rate in Indonesia, which is 29.47% (Ina, Selly, & Feoh, 2020).

Risk factors for hypertension include genetic factors, age, gender, ethnicity, stress, obesity, salt intake, and smoking habits. High blood pressure is caused by obesity from genetic factors or influencing environment. Gene-obesity interactions result in different heritabilities for diastolic blood pressure at different levels of obesity. Genetic factors also influence body mass index by contributing 6% and 7% of the total variance for systolic blood pressure and diastolic blood pressure respectively (Hamria, Mien, & Saranani, 2020).

Hypertension has a multifaceted impact, including 7.5 million deaths, lost income, health care costs and losses to governments. In Nigeria, 16.4% of households spend money on health care which can increase poverty by 0.8% of Nigeria's population of 1.3 million people. High blood pressure can be very risk because it can lead to serious health problems such as cardiovascular disease, kidney dysfunction and stroke which can cause death (Azahra, 2023).

Body Mass Index (BMI) is simple method that is commonly used to measure of a person's body. BMI is believed to be an indicator or describe the level of fat in the human body. Measurement and assessment using BMI is also related to deficiency and excess nutritional status. Undernutrition can pose a risk to infectious diseases. Overnutrition with excessive body fat accumulation increases the risk of suffering from degenerative diseases (Nuzula, 2023).

Body Mass Index (BMI) is very influential on the incidence of hypertension, where excess BMI or overweight can trigger higher risk factors for hypertension than someone with normal BMI. Obesity, especially abdominal obesity, is a risk factor for cardiovascular disease. Furthermore, it is also explained that obesity is a risk factor for increased blood pressure and triglyceride levels, which in turn are risk factors for cardiovascular disease. Based on data from the Ministry of Health of the Republic of Indonesia, the obesity group increases the risk of hypertension by 2.79 times. Furthermore, it was explained that the risk of hypertension increased by 1.40 times in people with abdominal obesity (Salakory, 2019).

The prevalence of obesity reaches 38%, while in Indonesia the figures vary by age group, with rates of 18.8% for ages 55-64 years, 18.9% for ages 65-74 years and 15.8% for ages >70 years. Obesity experienced by a person has the potential to cause hypertension for sufferers. This is because the fat deposits will put continuous pressure on the blood vessels in the body which will eventually trigger hypertension. Uncontrolled hypertension will trigger various other health problems (Hambali, & Suwandar, 2020).

RESEARCH METHOD

A cross sectional approach, specially focusing on a descriptive quantitative. The study took place from July to Agust 2024, in Girang Community Health Center. The independent variable was hypertension and dependent variable was body mass index. Using purposive sampling and the Slovin formula, 100 participants were selected. The inclusion criteria required age < 65 years, have a history of hypertension, agree to be a respondent, while exclusion criteria involved hypertensive patients who have complications hypertension such as heart disease, stroke, renal failure kidney failure.

Data collection utilized two instrument. A hypertension was obtained through measurements with sphygmomanometer and questionnaire forms. Blood pressure results are said to be normal if

Istiana Annisa*, Hadits Lissentiya Armal, Rian Bayu Santya Mahardhika

Politeknik Kesehatan Kementerian Kesehatan Banten
Corresponding author. *E-mail: istiana.annisa.job@gmail.com

DOI: https://doi.org/10.33024/minh.v7i7.621

systolic ≤120 mmHg, categorized as hypertension if ≥120 mmHg.

Body mass index variables were measured using digital scales for body weight with an accuracy of 0.1 kg and microtoise to measure height manually with an accuracy of 0.2 cm. BMI or body mass index (BMI) is expressed by body weight (kg) divided by height (m2), BMI formula = kg/m2. BMI is categorized into five, including; very thin (<17.0 kg), thin (17.0-18.5 kg), normal (>18.5-25.0 kg), overweight (>25.0-27.0 kg), and obese (>27.0 kg).

The analysis proceeded with a univariate test to determine the frequency distribution of respondents' characteristics, followed by bivariate analysis using chi-square and multivariate analysis used multiple logistic regression. All analyses were conducted using SPSS 24. This research has obtained permission and recommendations from the Research Ethics Commission of Yatsi Madani University with number. 214/LPPM-UVM/VI/2024 on June 24, 2024.

RESEARCH RESULTS

Table 1. Characteristic of Respondents (N=100)

Variables	Results
Age (n/%)	
(Mean±SD)(Range)(Year)	(51.02±2.723)(45-55)
45-48	16/16
49-52	54/54
53-55	30/30
Gender (n/%)	
Male	61/61
Female	39/39
Employment (n/%)	
Employed	67/67
Unemployed	33/33
Body Mass Index (BMI) (n/%)	
Very thin (< 17,0)	10/10
Thin (17,0 - 18,5)	25/25
Normal (> 18,5 - 25,0)	19/19
Overweight (25,0 - 27,0)	27/27
Obesity (> 27,0)	19/19
Genetic (n/%)	
Heredity	62/62
Inheritance	38/38
Hypertension (n/%)	
>120 mmHg	60/60
≤120 mmHg	40/40

Table 1 shows the characteristics of participants with a mean age and standard deviation (51.02±2.723) ranging from 45-55 years old. Most of the respondents in the gender of male 61 (61%). Majority of respondents had employed 67 (67%). Majority of respondents had BMI in the overweight category 27 (27%). Most of the respondents have a hereditary hypertension 62 (62%). Majority of respondents had hypertension 60 (60%).

Istiana Annisa*, Hadits Lissentiya Armal, Rian Bayu Santya Mahardhika

Politeknik Kesehatan Kementerian Kesehatan Banten
Corresponding author. *E-mail: istiana.annisa.job@gmail.com

DOI: https://doi.org/10.33024/minh.v7i7.621

Table 2. Relationship Between Body Mass Index (BMI) and Genetic with Hypertension (N=100)

Variable	OR (CI 95%)	p-value
Body Mass Index (BMI)	1.903	0.009
Genetic	3.441	0.011

Table 2. Show the hypothesis test results show a significance ($p < 0.05$) it means there is a relationship between body mass index and genetic with hypertension. The genetic variable that is most related to the incidence of hypertension is genetics with an odds ratio value of 3.441, meaning that respondents who have genetic hypertension have a 3.4 times chance of experiencing hypertension compared to respondents who do not have genetic hypertension. Meanwhile, the BMI variable has an odds ratio value of 1.903, meaning that respondents who have an abnormal BMI have a 1.9 times chance of experiencing hypertension compared to respondents who have a normal BMI.

DISCUSSION

Based on Body Mass Index (BMI), overweight was found, namely 27 respondents (27%), in someone who has a BMI, overweight and obesity can increase blood pressure. This is because as body weight increases, the amount of fat in the body increases. If overweight and obesity occurs for a long time it can affect the amount of oxygen and blood flow which will carry oxygen throughout the body. Therefore, the blood vessels enlarge, so blood pressure also increases. This excess weight can cause additional fat tissue and increased blood flow. The occurrence of increased blood pressure can also be caused by an increase in heart rate and a reduced capacity of blood vessels to transport blood (Kartika, Subakir, & Misriyanto, 2021).

Body Mass Index (BMI) goes hand in hand with an increase in blood pressure. When BMI is normal, blood pressure is also normal. However, if IMT shows obesity, the risk of hypertension increases. In line with other studies that have been conducted, it shows that high BMI increases the risk of blood pressure. The Odds Ratio (OR) also increases as BMI increases, especially when BMI exceeds 25 (Ahmad, 2022). Another theory states that the elderly experience a decrease in systolic longitudinal atrial elasticity making the atria stiff. As a result, blood is forced through narrower blood vessels at each heartbeat resulting in increased blood pressure (Setiani, & Wulandari, 2023).

Body Mass Index (BMI) is very influential on the incidence of hypertension, where excessive BMI or overweight can trigger higher risk factors for hypertension than someone with normal BMI. BMI is also associated with the incidence of hypertension in both men and women (Abineno, & Malinti, 2022). Obesity is one of the factors of hypertension. When someone is obese or in other words has excessive body weight, that 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 (Andini, 2019).

Genetics, the highest is Heredity of Hypertension, namely 62 respondents (62%). Genetics is the part of the chromosome that functions as a carrier of traits. An alternative gene that explains variations in the inheritance of a trait is called an allele (a gene that has the same locus). Genes that play a role in the mechanism of hypertension are genes that influence sodium homeostasis in the kidney, including the I/D polymorphism (insertion/deletion) of the ACE (angiotensin converting enzyme) gene, and genes that influence steroid metabolism. Studies state that the I/D polymorphism of the ACE gene can produce 3 genotypes, II homozygous, ID heterozygous and DD homozygous. Individuals with homozygous DD have higher ACE concentrations compared to others. With higher ACE concentrations, angiotensin II concentrations also increase. High angiotensin II can cause a progressive increase in blood pressure through 2 mechanisms, vasoconstriction in peripheral arteries and decreased excretion of salt and water by the kidneys (Paula, Yundari, & Fran, 2020).

The results obtained from this study are supported by the findings which state that there is a significant influence between family history and the

Istiana Annisa*, Hadits Lissentiya Armal, Rian Bayu Santya Mahardhika

Politeknik Kesehatan Kementerian Kesehatan Banten
Corresponding author. *E-mail: istiana.annisa.job@gmail.com

DOI: https://doi.org/10.33024/minh.v7i7.621

incidence of hypertension. People who have a family history of hypertension are more at risk than those who do not have a family suffering from hypertension. Other studies that are also in line with the results obtained show that family history affects the incidence of hypertension (Astuti, Tasman, & Amri, 2021).

Genetic factors that play a role in the incidence of hypertension are dominant in hypertension influenced by many genes (polygenic hypertension). Polygenic hypertension is caused by major genes and many minor genes. Some genes involve systems that play a role in the mechanism of hypertension, namely the rennin-angiotensin-aldosterone (RAA) system, G-protein/signal transduction pathways system, noradrogenic system, ion channels, α adduction, and immune system and inflammation (Ansar, Dwinata, & Apriyani, 2019). According to Mendel's law, if only one of the parents suffers from hypertension, then the probability of the child not suffering from hypertension is 50% (Supriyono, 2019). Hypertension tends to be a hereditary disease, if one of the parents suffers from hypertension then throughout life the offspring has a 25% chance of suffering from hypertension.If both parents suffer from hypertension then there is a 60% chance that their offspring will suffer from hypertension. A close family history of hypertension also increases the risk of developing hypertension, especially primary hypertension (Azzubaidi, Rachman, Muchsin, & Nurmadilla, 2023).

Multivariate modeling results, it was found that the genetic variable that was most related to the incidence of hypertension was genetics with an OR value of 3.441, meaning that respondents who had genetic hypertension had a 3.4 times chance of experiencing hypertension compared to respondents who did not have genetic hypertension, this is in line with the theory in the book. The pocket of hypertension is that a person's genetics (heredity) is likely to suffer if their parents also suffer from hypertension (Tika, 2021).

CONCLUSION

The results show a significance ($p < 0.05$) it means there is a relationship between body mass index and genetic with hypertension. The genetic variable that is most related to the incidence of hypertension is genetics with an odds ratio value of 3.441, meaning that respondents who have genetic hypertension have a 3.4 times chance of experiencing hypertension compared to respondents who do not have genetic hypertension. Meanwhile, the BMI variable has an odds ratio value of 1.903, meaning that respondents who have an abnormal BMI have a 1.9 times chance of experiencing hypertension compared to respondents who have a normal BMI.

REFERENCES

Abineno, A. P., & Malinti, E. (2022). Hubungan Indeks Massa Tubuh Dengan Tekanan Darah Pada Orang Dewasa. *Indonesian Journal Of Nursing And Health Sciences*, *3*(1), 37-42.

Ahmad, S. N. A. (2022). Edukasi Kesehatan Dan Deteksi Dini Diabetes Melitus Dan Hipertensi Di Kelurahan Batu Ceper. *AMMA: Jurnal Pengabdian Masyarakat*, *1*(03), 117-121.

Andini, R. (2019). Indeks Massa Tubuh Sebagai Faktor Risiko Pada Gangguan Muskuloskeletal. *Jurnal Ilmiah Kesehatan Sandi Husada*, *8*(2), 316-320.

Ansar, J., Dwinata, I., & Apriani, M. (2019). Determinan Kejadian Hipertensi Pada Pengunjung Posbindu Di Wilayah Kerja Puskesmas Ballaparang Kota Makassar. *Jurnal Nasional Ilmu Kesehatan*, *1*(3), 28-35.

Astuti, V. W., Tasman, T., & Amri, L. F. (2021). Prevalensi Dan Analisis Faktor Risiko Hipertensi Di Wilayah Kerja Puskesmas Nanggalo Padang. *Berkala Ilmiah Mahasiswa Ilmu Keperawatan Indonesia*, *9*(1).

Azahra, H. (2023). *Analisis Faktor Yang Berhubungan Dengan Kejadian Hipertensi Pada Lansia Di Puskesmas Kecamatan Jagakarsa Jakarta Selatan Tahun 2023* (Doctoral Dissertation, Universitas Nasional).

Azzubaidi, S. B. S., Rachman, M. E., Muchsin, A. H., & Nurmadilla, N. (2023). Hubungan Tekanan Darah Dengan IMT (Indeks Massa Tubuh) Pada Mahasiswa Angkatan 2020 Fakultas Kedokteran

Istiana Annisa*, Hadits Lissentiya Armal, Rian Bayu Santya Mahardhika

Politeknik Kesehatan Kementerian Kesehatan Banten
Corresponding author. *E-mail: istiana.annisa.job@gmail.com

DOI: https://doi.org/10.33024/minh.v7i7.621

Universitas Muslim Indonesia. *Fakumi Medical Journal: Jurnal Mahasiswa Kedokteran*, *3*(1), 54-61.

Hamria, H., Mien, M., & Saranani, M. (2020). Hubungan Pola Hidup Penderita Hipertensi Dengan Kejadian Hipertensi Di Wilayah Kerja Puskesmas Batalaiworu Kabupaten Muna. *Jurnal Keperawatan*, *4*(01).

Hambali, S., & Suwandar, E. (2020). Erratum: Indeks Massa Tubuh Atlet Senam Artistik Jawa Barat. *JUARA: Jurnal Olahraga*, *5*(1), 110-110.

Ina, S. J., Selly, J. B., & Feoh, F. T. (2020). Analisis Hubungan Faktor Genetik Dengan Kejadian Hipertensi Pada Usia Dewasa Muda (19-49 Tahun) Di Puskesmas Bakunase Kota Kupang Tahun 2020. *Chmk Health Journal*, *4*(3), 217-221.

Kartika, M., Subakir, S., & Mirsiyanto, E. (2021). Faktor-Faktor Risiko Yang Berhubungan Dengan Hipertensi Di Wilayah Kerja Puskesmas Rawang Kota Sungai Penuh Tahun 2020. *Jurnal Kesmas Jambi*, *5*(1), 1-9.

Lestari, K. F., Yulianti, S., & Tebisi, J. M. (2022). Analisis Dukungan Keluarga, Tingkat Pengetahuan, Dan Keterjangkauan Akses Ke Pelayanan Kesehatan Terhadap Penerapan Program Patuh Lansia Hipertensi. *Jurnal Keperawatan Silampari*, *6*(1), 556-565.

Nuzula, S. Z. (2023). *Studi Deskriptif Penggunaan Obat Antihipertensi Di Unit Pelaksana Teknis Puskesmas Junrejo* (Doctoral Dissertation, Universitas Islam Negeri Maulana Malik Ibrahim).

Paula, P., Yundari, Y., & Fran, F. (2020). Aljabar Nonasosiatif Dan Nonkomutatif Terkait Mutasi. *Bimaster: Buletin Ilmiah Matematika, Statistika Dan Terapannya*, *9*(4).

Rahmadhani, M. (2021). Faktor-Faktor Yang Mempengaruhi Terjadinya Hipertensi Pada Masyarakat Di Kampung Bedagai Kota Pinang. *Jurnal Kedokteran STM (Sains Dan Teknologi Medik)*, *4*(1), 52-62.

Setiani, R., & Wulandari, S. A. (2023). Hubungan Faktor Genetik Dengan Kejadian Hipertensi: Scoping Review. *Jurnal Integrasi Kesehatan & Sains*, *5*(1), 60-66.

Salakory, J. A. (2019). Asuhan Keperawatan Pemberian Jus Mentimun Untuk Menurunkan Tekanan Darah Pada Penderita Hipertensi Di Wilayah Kerja Puskesmas Wamlana Kecamatan Fena Leisela Kabupaten Buru. *Global Health Science*, *4*(1).

Supriyono, S. (2019). Analisis Faktor-Faktor Yang Berhubungan Tekanan Darah Sistole Pada Peserta Pelatihan Manajemen Puskesmas. *Jurnal Inspirasi*, *10*(1), 32-48.

Tika, T. T. (2021). Pengaruh Pemberian Daun Salam (Syzygium Polyanthum) Pada Penyakit Hipertensi: Sebuah Studi Literatur. *Jurnal Medika Hutama*, *3*(01 Oktober), 1260-1265.

Yhuwono, Y. (2018). Hubungan Indeks Massa Tubuh Dengan Tekanan Darah Pada Lansia Di Desa Pesucen, Banyuwangi. *Jurnal Kesehatan Masyarakat Indonesia*, *13*(1).

Istiana Annisa*, Hadits Lissentiya Armal, Rian Bayu Santya Mahardhika

Politeknik Kesehatan Kementerian Kesehatan Banten
Corresponding author. *E-mail: istiana.annisa.job@gmail.com

DOI: https://doi.org/10.33024/minh.v7i7.621