Prevalence Study of Prehypertension, Hypertension, and Risk Factors in the Adult Population in Medan, Indonesia: A Community Cross-Sectional Study

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Abstract

Background: Prehypertension and hypertension are serious public health issues that are frequently disregarded. The condition is linked to morbidity and is known to increase the risk of kidney, cardiovascular, and cerebrovascular illness. Objectives: The objective of this study was to determine the prevalence of pre hypertension and hypertension and factors associated among the adult population Settings and Design: This was an observational study with cross sectional design. Methods and Materials: The sample included 200 recruits from 4 subdistricts in Medan city that selected using purposive sampling. Data were collected by interviews and measurements. Statistical analysis: Data were analyzed using multiple logistic regression. Results: Prevalence of hypertension as 24.5% an hypertension as much as 34.5%. The majority of respondents were aged 45 years or younger (66.0%), 185 were female (92.5%), 124 were low income (62.0%), 143 had no family history (71.5%), 95 were overweight (47.5%), 137 were normal blood glucose, 183 had no smoking habit (91.5%), and 134 were physically inactive (67,0%). Of the Multiple Logistic regression showed that Basal metabolic index and daily vegetables and fruit consumption are significant factors contribute to prehypertenion, while age, Basal metabolic index and daily vegetables and fruit consumption are significant factors contribute to hypertension among adult population in Medan City. Conclusions: BMI and daily vegetables and fruit consumption are signifant factors to pre hypertension, while BMI and daily vegetables and fruit consumption are significant factors to hypertension among adult population. Intervention programs should be primarily focused on the risk factors such as losing weight and maintaining an ideal body weight and implementing healthy lifestyle.

Keywords: Pre Hypertension, Hypertension, Prevalence, Determinant.

INTRODUCTION

Hypertension is one of the most prevalent non-communicable diseases in many countries (Izza, 2023) (Susanti, 2020). It is estimated that more than one billion people suffer from hypertension, with projections showing an increase to 1.15 billion by 2025, contributing to approximately 9.4 million deaths each year (Ayu, 2023) (Aliyah, 2025). The prevalence in the United States and China exceeds 30% in adults, and Saudi Arabia has a prevalence of more than 50% (Lydia, 2021). The global prevalence of hypertension nearly doubled from 650 million in 1990 to 1.3 billion in 2019, with the highest prevalence recorded in Africa (27%) and Southeast Asia ranking third with 25% (Luqyana, 2025).

Hypertension is also a serious public health problem in Indonesia. Indonesian data shows a significant increase in prevalence from 25.8% in 2013 to 34.1% in 2018 (Putri, 2024). This increasing trend places Indonesia among the Southeast Asian countries with the highest

burden of hypertension (Hasibuan, 2023). Hypertension in Indonesia is estimated to occur in one in three Indonesians, with the majority of people not complying with treatment regimens or regular blood pressure monitoring (Telaumbanua, 2021) (Maulia, 2021). This alarming prevalence necessitates immediate investigation of contributing factors and the development of effective intervention strategies (Putri, 2024) (Aryatika, 2023). Public knowledge about hypertension is still lacking, often resulting in asymptomatic hypertension and irregular treatment (Aliyah, 2025).

Early detection of prehypertension is crucial in preventing complications such as cardiovascular and cerebrovascular diseases, as well as all-cause mortality, especially given the limited data on its prevalence among middle-aged and elderly populations in Indonesia (Lydia, 2021). The high prevalence of hypertension highlights the importance of conducting in-depth research on the prevalence of hypertension and prehypertension, along with related risk factors, in specific regional contexts such as Medan, Indonesia (Hasibuan, 2023) (Kristian, 2022). Many adults are unaware that they have symptoms of hypertension, resulting in delayed diagnosis and suboptimal treatment (Nugroho, 2025). Hypertensive patients in the Tayu coastal area were over 65 years of age (40.9%) and mostly female (75.3%), with a basic education (32.4%) and housewives (35.2%). Hypertensive patients in the Tayu coastal area demonstrated poor health maintenance behaviour (Izza, 2023).

Hypertension is a serious health problem that could impact the quality of life. The prevalence of hypertension varies among populations, and its occurrence is influenced by both individual and environmental factors. The demographic and socioeconomic characteristics of individuals and environmental factors are associated with health problems, including hypertension (Iqbal, 2021) (Kreutz, 2021). Lower education, unhealthy habits related to diet, physical activity, and the use of health services can also increase the risk of hypertension (Banjarnahor, 2023) (Ikhwan, 2021).

The high prevalence of hypertension makes hypertension a public health and the disease is related to behavior that can actually be prevented. The demographic and socioeconomic characteristics of individuals, environmental factors in places where people live are also associated with health problems including hypertension (F. A. Siregar, 2025). Lower education levels of residence promote unhealthy habits related to diet, physical activity, and use of health services can also increase the risk of hypertension (P. A. Siregar, 2020). This study is important to determine the influence of individual characteristics and risk behavior on the incidence of hypertension.

METHODS

Subjects and Methods

This study was an observational study with cross sectional design. The recruited sample included 200 people who were selected by purposive sampling. This study was carried out in 4 subdistrict from four health facilities in the city of Medan from May to October 2020.

Data were collected with interviews using structured questionnaires and measurements. Blood pressure was measured twice using a sphygmomanometer with 5-minute intervals. Hypertension was defined as an average diastolic blood pressure of 90 mmHg or more. Height was measured using a Microtoise GEA stadiometer, and body weight was evaluated using a digital scale to determine body mass index. Individuals with a BMI ≥ 25 kg/m2 were defined as overweight, those with a BMI ≥ 30 kg/m2 were defined as being obese, and those with a BMI<18.5 kg/m2 were considered underweight.

The structured questionnaire included information about individual characteristics (sex, age, education level, occupation, income, family history of hypertension, family history of diabetes and obesity), risk factors (high blood pressure, central obesity, and nutritional status) and risk behavior (alcohol consumption, smoking habits, physical activity and vegetables and fruits consumption). Data were analyzed using the Statistical Package for Social Science (Release 24.0 program, SPSS, Inc., Chicago, Illinois, USA). The results of the descriptive analysis of the variables are presented either as frequency distributions or proportions. The association factors with hypertension was analyzed using simple logistic regressions and then followed by multiple logistic regression.

Ethical Consideration

This study was carried out with approval of the Research and Ethics Committee After obtaining informed consent and ethical approval from School Medical, Universitas Sumatera Utara (Reference code number 129/KEP/ USU 2020)

RESULT

A total 0f 200 individual participate in this study. The mean age was 39.5(7.6) years, mean body weight was 64.5 (13.9) kg, mean height was 153.9 (7.5) cm, mean blood glucose was) 95.3 (38.8) mg/dl and mean of waist cimcumference was 96.5 (12.4) as presented in Table 1.

Table 1. Distribution of respondents according to characteristic

Variabel	Minimum	Maksimum	Mean (SD)
Age	23	57	39.5(7.6)
Weight	38	114	64.5 (13.9)
Height	133	180	153.9 (7.5)
Waist circumference	62	132	96.5 (12.4)
Blood glucose	42	378	95.3 (38.8)

The majority of respondents (132) were aged 45 years or youner (66.0%), 185 (92.5%) were female, 164 (82.0%) had a high education level, 124 (62.0%) had an income less than 2.9 million, 143 (71.5%) had no family history of hypertension, 186 (93.0%) had no family history of obesity, and 157 (78.5%) had no family history with diabetes as presented in Table 2. Furthermore, based on risk factors, majority respondent were obesity 95 (47.5%), 174 (87.0%) with central obesity, 82 (41.0%) with normal blood pressure and 134 (68.5%) with normal blood glucose(Table 3). According to risk behavior, the majority of respondents did not have a smoking habit 183(91.5%). 99.5% had no habitual alcohol consumption, 134 were physically inactive (67%), and 153 were with daily consuming vegerables and fruits as presented in Table 4.

Table 2. Distribution of respondents according to socio-demographic factors

Variable	Frequency	Percentage
Age		
< 45 years	132	66.0%
≥ 45 years	68	34.0%
Sex		
Male	15	7.5
Female	185	92.5
Education		
Low	36	18.0
High	164	82.0
Income		
< 2.9 million	124	62.0
≥2.9 miliion	76	38.0
Family history with hypertension		
Yes	57	28.5
No	143	71.5
Family history with obesity		
Yes	14	7.0
No	186	93.0
Family history with diabetes		
Yes	43	21.5
No	157	78.5

Table 3. Distribution of respondents according to risk factor

Variable	Frequency	Percentage
Basal metabolic index (BMI)		
Underweight	4	2.0
Normal	72	36.0
Overweight	28	14.0
Obesity	95	47.5
Central obesity		
No	26	13.0
Yes	174	87.0
Blood pressure		
Normal	82	41.0
Pre hipertension	49	24.5
Hipertension	69	34.5
Capillary blood glucose		
Normal	137	68.5
Prediabetes	24	12.0
Diabetes	39	19.5

Tabel 4. Distribution of respondents according to risk behavior

Variable	Frequency	Percentage
Smoking habit		
Yes	17	8.5
No	183	91.5
Alcohol consumption		
Yes	1	0.5
No	199	99.5
Regular physical activity		
No	66	33.0
Yes	134	67.0
Vegetables and fruits consumption		
Daily	153	76.5
Non daily	47	23.5

Of the single analysis using simple logistic regression, variables such as age, education, family history with diabetes, BMI, Blood glucose level, physical activity and vegetables and fruits consumption were significant, with p values less than 0.25 (Table 4). Furthermore, multivariate logistic regression was performed.

Table 5. Factors associated with prehypertension and hypertension using simple logistic regression

Variable	p	RP (95%CI)
Age	0.001	2.91 (1.53; 5.56)
Sex	0,532	0.70 (0.23; 2.13)
Education	0.163	0.58 (0.27;1,25)
Income	0.731	0.90(0.50;1.62)
Family history with hypertension	0.451	0.78 (0.42;1.48)
Family history with diabetes	0.206	0.63 (0.31; 1.29)

Variable	p	RP (95%CI)
Family history with obesity	0.333	0.55(1.17; 1.83)
BMI	0.000	3.94(2.16;7.19)
Waist circumference	0.319	1.52 (0.67; 3.48)
Blood glucose level	0.002	1.89(1.27; 283)
Smoking habit	0.618	0.77(0.27; 2.17
Alcohol consumption	1.000	1.00(0.00-0.00)
Physical activity	0.123	0.62(0.33;1.14)
Vegetables and fruits consumption	0.001	3.04(1.54;5.97)

Table 6. Factors associated with prehypertension and hypertension using Multiple logistic regression

Variable	p	RP (95%CI)
Age	0.005	2.76 (1.37; 5.57)
Nutritional status	0.000	2.25 (1.61;3.15)
Vegetables and Fruits Consumption	0.005	2.91(1.38;6.15)

Of the multivariate Logistic Regression, revealed that age, nutritional status and vegetables and fruits consumption were predictors of pre hyertension and hypertension. People aged ≥ 45 years have 2.76 times at risk to get hypertension compared to <45 years of age (RP 2.76 (1.37; 5.57)). People who have overweight have 2.25 times at risk to get hypertension compared to people who have normal nutritional status (RP 2.25 (1.61;3.15). People who have nondaily vegetables and fruits consumption had 2.91times at risk to get hypertension compared to those who have daily vegetables and fruits consumption (2.91(1.38;6.15).

DISCUSSION

Age plays a role in the occurrence of hypertension. The prevalence of hypertension increases with age. Aging is associated with a number of changes in the cardiovascular system. One of them is the hardening of the large arteries, namely the process of arteriosclerosis. The increase in the prevalence of hypertension in the elderly emphasises that physiological ageing correlates with an increase in blood pressure (Ambreen, 2025) (Rahmatika, 2019). The increase in the prevalence of hypertension is related to natural changes in the cardiovascular system, such as hardening of the arteries and reduced blood vessel elasticity, which occur as part of the ageing process (Maulidina, 2019). The progressive increase in the prevalence of hypertension with age is related to the cumulative effects of degenerative processes on the arterial walls, which cause thickening and decreased elasticity, thereby increasing the likelihood of high blood pressure (Wacika, 2024). Physiological changes result in an increase in systolic and diastolic blood pressure, putting the elderly at risk of hypertension (Fitriana, 2025).

This study show people aged ≥ 45 years have 2.76 times at risk to get hypertension compared to <45 years of age (RP 2.76 (1.37; 5.57)).Individuals aged 45–59 years have a higher risk of hypertension compared to younger age groups, with this risk increasing further in those aged 60–74 years (Rahmatika, 2019). There is an increase in the prevalence of hypertension cases in individuals aged 65-74 years and an even higher proportion in those aged 75 years and above (Utomo, 2024). Increased peripheral vascular resistance and sympathetic activity in individuals over 45 years of age will increase the risk of hypertension (Kartika, 2017).

Public health interventions are urgent for at-risk groups through early detection and hypertension management strategies in middle-aged and elderly adults (Ambreen, 2025) (Musdalifah, 2020). The importance of regular blood pressure checks and lifestyle changes for the elderly are important factors (Eka, 2018) (Nugroho, 2025). The disproportionate impact on high-risk groups such as the elderly requires intervention as they age, due to factors such as decreased arterial elasticity and increased vascular resistance (Sumiasih, 2020).

Obesity is known as a risk factor for hypertension, which causes activation of the sympathetic nervous system (SNS); intra-abdominal and intravascular fat; sodium retention, leading to increased renal reabsorption; and activation of the renin-angiotensin system. In addition, obesity is also associated with increased blood flow, vasodilation, cardiac output, and arterial hypertension. Obesity is associated with hypertension in adults (Meouchy, 2022).

People who have overweight have 2.25 times at risk to get hypertension compared to people who have normal nutritional status (RP 2.25 (1.61;3.15). Individuals who are obese are 4.375 times more likely to suffer from hypertension (Yanti, 2018). Excess fat tissue contributes to increased peripheral resistance and higher cardiac workload, thereby increasing the risk of hypertension (Utami, Syafriani, and Isnaeni 2021). Increased body mass requires a greater volume of blood circulation to supply oxygen and nutrients to tissues, which increases pressure on the arterial walls (Utami, 2021).

This physiological stress can cause endothelial dysfunction and arterial hardening, which further exacerbates the process of hypertension (Mills, 2020). Nutritional status with a BMI ≥25 increases the risk of hypertension by 3.05 times, reinforcing the notion that even in young populations, increased BMI is a strong risk factor (Putri, 2024)v. Obesity also activates mineralocorticoid receptors independently of aldosterone or angiotensin II, contributing to the pathogenesis of hypertension (Debora, 2023). The mechanisms behind hypertension in obese individuals are also closely related to insulin resistance, sodium retention, increased

sympathetic nervous system activity, and activation of the renin-angiotensin-aldosterone system (Czapla, 2022).

The frequency of consumption of fruits and vegetables can reduce hypertension quite well. The flavonoids in the fruit can function as ACE inhibitors, increase endothelial function and repair endothelium which can lower blood pressure. In this study, it was found that there was a relationship between the habit of consuming fruits and vegetables with the incidence of hypertension. The frequency of consumption of fruits and vegetables can reduce hypertension quite well. The flavonoids in the fruit can function as ACE inhibitors, improve endothelial function and repair endothelium which can lower blood pressure. Green vegetables that have many benefits for health and body growth. In it there is quite a lot of protein, minerals, calcium, potassium, iron, and vitamins needed by the human body. Increasing daily calcium intake can help prevent and treat hypertension and osteoporosis.

CONCLUSION

Hypertension and prehypertension are substantial public health challenges among the adult population. The main determinants contributing to these conditions are middle-aged and older age groups, nutritional status classified as overweight or obese, and insufficient daily consumption of vegetables and fruit. It is important to adopt a primary prevention approach that focuses on lifestyle modification, particularly in weight management and increasing fibre intake. Structured and sustainable community-based interventions are needed to address these modifiable risk factors, thereby reducing the burden of cardiovascular disease and improving the overall quality of life of the population.

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