Behavioral and Sociodemographic Risk Factors of High Blood Pressure Among Community in Medan City

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Abstract

High blood pressure, or hypertension, is a global health concern with a persistently high prevalence. Despite this, there is a lack of consensus on the established risk factors for hypertension. This study aimed to identify significant risk factors for hypertension. Utilizing a cross-sectional, observational design, the study included 200 purposively selected participants from four subdistricts in Medan City. We collected data through interviews and direct measurements and then analyzed them using simple and multiple logistic regression. The prevalence of high blood pressure was 59.0%, comprising 24.5% pre-hypertension and 34.5% hypertension. The majority of respondents (66.0%) were 45 years or younger, 185 were female (92.5%), 124 fell into the low-income category (62.0%), 143 had no family history of hypertension (71.5%), 95 were overweight (47.5%), 137 had normal blood glucose levels (68.5%), 183 were non-smokers (91.5%), and 134 were physically inactive (67.0%). Multiple logistic regression analysis identified age, body mass index (BMI), and daily vegetable and fruit consumption as significant contributors to high blood pressure in this population. The findings underscore the urgent need for targeted intervention programs focused on risk factors such as weight reduction, maintaining an ideal body weight, and promoting healthy lifestyle practices, including increased consumption of vegetables and fruits.

Keyword: Consumption, Fruit, Health, High blood pressure

INTRODUCTION

Hypertension has emerged as a significant public health concern, characterized by high prevalence and mortality rates, as well as severe complications. By 2025, projections indicate that hypertension will affect approximately 1.5 billion (29.2%) adults worldwide, with 17.3% of individuals in developing countries (Lim et al., 2012). According to basic health research data, 34.1 out of every 100.000 people in Indonesia had hypertension in 2018 (Ministry of Health RI, 2018) and majority have no symptoms. In addition, only 4% have controlled hypertension with the proportion of deaths due to hypertension in Indonesia was 6.7% (Ministry of Health RI, 2018). In North Sumatera Province, the prevalence of hypertension tended to increase from 24.7% in 2013 to 30% in 2018 (Ministry of Health RI, 2018). Likewise, in the city of Medan, as 22.53% of the population having hypertension in 2017.

The prevalence of hypertension varies among countries and its occurrence is influenced both individual and environmental factors (Banjarnahor, 2023). Some studies have found that the socio-demographic and environmental factors are associated with high blood pressure

(Chaix et al., 2010); (Hasibuan, 2023), including lower education, overweight and unhealthy behaviour related to diet, smoking habits, alcohol consumption and physical activity could increase the risk of hypertension (Bhise & Patra, 2018). Lower levels of education among residents encourage bad eating, exercise, and health care utilisation habits, which can further raise the risk of hypertension (Chaix et al., 2010).

The DASH (Dietary Approaches to Stop Hypertension) diet is a nutrient-rich diet promoting fruits, vegetables, whole grains, nuts, fish, and low-fat dairy products, reducing blood pressure by limiting salt and sugar intake and excluding processed meats (Astuti, 2021). Adopting a healthy lifestyle that includes increased consumption of vegetables and fruits can help manage hypertension (Novianti, 2022).

Chayote, a plant with anti-inflammatory properties, effectively manages hypertension due to its diuretic effects (Indriyani, 2020). These effects reduce sodium levels through urinary excretion, thereby lowering blood pressure. One approach is the utilization of tomato juice, which can be administered to individuals with hypertension as a form of non-pharmacological intervention. Other measures include maintaining a healthy weight, limiting daily salt intake to no more than 2 grams, engaging in regular physical activity, reducing alcohol consumption, and refraining from smoking (Ikhwan, 2021); (Tarigan, 2021).

METHODS

This study was an observational study with cross sectional design. The recruited sample included 200 people who were purposively selected from 4 subdistrict from Medan City from May to October 2020. Measurements and structured questionnaires were used in interviews to gather data. A sphygmomanometer was used to take blood pressure twice at 5-minute intervals. An average diastolic blood pressure of 90 mmHg or higher was considered hypertension. A Microtoise GEA stadiometer was used to measure height, and a digital scale was used to calculate body mass index by weighing the subjects. Overweight people were characterised as having a BMI of 25 kg/m^2, obese people as having a BMI of 30 kg/m^2, and underweight people as having a BMI of less than 18.5 kg/m^2.

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). The Statistical Package for Social Science (Release 24.0 software, SPSS, Inc., Chicago, Illinois, USA) was used to analyse the data. Either proportions or frequency

distributions are used to display the findings of the descriptive analysis of the variables. Simple logistic regressions and multiple logistic regressions were used to examine the factors associated with hypertension. The Research and Ethics Committee gave its approval for this study to be conducted. Following ethical permission and informed consent from School Medical, Universitas Sumatera Utara (Reference code number 129/KEP/ USU 2020).

RESULTS

Table 1 Characteristics of Respondents

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)

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 2 Distribution of respondents according to socio-demographic factors

Variable	n	%
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

The majority of respondents (132) were aged 45 years or younger (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 vegetables and fruits as presented in Table 4.

Table 3 Distribution of respondents according to risk factor

Variable	n	%
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

Table 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 high blood pressure 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)
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 habt	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)
Vegerables and fruits consumption	0.001	3.04(1.54;5.97)

Table 6 Factors associated with high blood pressure 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 high blood pressure. People aged ≥ 45 years have 2.76 times at risk to get high blood pressure 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 high blood pressure compared to people who have normal nutritional status (RP 2.25 (1.61;3.15). People who have non daily 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

The Effect of Age on High Blood Pressure

The results showed that the prevalence of high blood pressure was 59.0%. Prevalence of pre hypertension was 24.5% and the prevalence of hypertension was 34.5%, with mean age was 39.5 (7.6), mean body weight was 64.5 (13.9), mean height was 153.9 (7.5), mean abdominal circumference was 96.5. (12.4) and a mean blood sugar level of 95.3 (38.8). From sociodemographic data, the majority of respondents in the age group <45 years (66.0%). In the age group <45 years, the largest proportion with normal blood pressure (49.2%), and the age group ≥45 years, the largest proportion with hypertensive blood pressure (55.9%).

Age is a significant factor in the development of hypertension, with its prevalence increasing as individuals advance in years. The ageing process is associated with various alterations in the cardiovascular system, including the progressive stiffening of large arteries,

a phenomenon known as arteriosclerosis. Numerous cross-sectional studies have demonstrated a linear relationship between aortic stiffening and advancing age. The high prevalence of isolated systolic hypertension in older adults is mainly due to the increased rigidity of the aorta. (Mc et al., 2007). Hypertension frequently occurs in individuals over 40 years of age, with this demographic exhibiting a significantly higher risk of developing elevated blood pressure compared to those under 40 years of age (Peltzer & Pengpid, 2018, Anteneh et al., 2015) .

The Effect of Nutritional Status on High Blood Pressure

The Hypertension Prevention and Control Program classified 90% to 95% of hypertension cases as essential hypertension, primarily influenced by factors such as physical inactivity, tobacco use, obesity, high-fat diets, alcohol consumption, and stress (Sammeng, 2021). People who have overweight have 2.25 times at risk to get high blood pressure compared to people who have normal nutritional status (RP 2.25 (1.61;3.15).

High blood pressure prevalence is higher in males (18.0% to 46.9%) than females (17.3% to 35.1%) in both non-overweight and overweight groups. Body fat distribution significantly influences HBP risk in non-overweight females. For overweight men, trunk fat mass to leg fat mass and android fat mass to gynoid fat mass are strong predictors (Chen, 2023). Overweight educators are 6.5 times more likely to develop hypertension compared to those with normal nutritional status. Addressing the nutritional status of educators in Islamic high schools is crucial for preventing hypertension and enabling optimal performance in both professional and personal capacities (Rosmiati, 2022).

Individuals who are overweight are 2.5 times more likely to develop high blood pressure compared to those with an average weight. A study conducted by Erem et al. in Turkey found that 66.6% of individuals with hypertension were overweight or obese, reinforcing this finding (Erem et al., 20008).

The sympathetic nervous system (SNS), intra-abdominal and intravascular fat, sodium retention, which increases renal reabsorption, and the renin-angiotensin system are all triggered by high blood pressure, which is a risk factor for obesity. Additionally, elevated blood flow, vasodilation, cardiac output, and arterial hypertension are linked to obesity (Jiang et al., 2016). About 26% of instances of hypertension in males and 28% in women are caused by being overweight or obese. The contadicting findings were found in Bahrami et al (2006) study, that found no relationship between hypertension and body weight. Low level of education is a risk

factor for hypertension (Bahrami et al., 2006). This is related to stress factors, working conditions and nutritional status.

The results Lima (2022) showed a correlation between elevated blood pressure levels and most participants (58.22%) being overweight. While the consumption of nutritious foods was evident, there was also a consistent intake of unhealthy foods. Male subjects exhibit a higher prevalence of high body mass index (HBP) compared to female subjects in both non-overweight and overweight categories. The ratio of T/L and A/G was determined to be a significant predictor of HBP in overweight male subjects (Chen, 2023).

The nutritional status of female Zumba participants was classified, on average, as overweight. Their mean blood pressure was categorized as pre-hypertensive, and their average waist circumference was deemed to be in the unsafe range. Nevertheless, the average uric acid levels of the female Zumba participants were within normal limits (Hita, 2022). Overweight can lead to obesity, causing degenerative diseases like diabetes, hypertension, and metabolic syndrome. Overnutrition leads to excess energy, forming adipose tissue, which is metabolically inactive (Sammeng, 2021).

The Effect of Vegetable and Fruit Consumption on High Blood Pressure

Numerous scientific studies have shown a strong link between consuming fruits and vegetables and regulating blood pressure (Susanti, 2020). These foods are rich in fibre, potassium, and antioxidants, crucial for maintaining vascular health. For example, potassium helps lower blood pressure by promoting sodium excretion through urine and reducing vascular tension. People who have non daily vegetables and fruits consumption had 2.91 times at risk to get hypertension compared to those who have daily vegetables and fruits consumption (2.91(1.38;6.15).

Regular consumption of fruits and vegetables can significantly reduce high blood pressure. Flavonoids found in fruits act as ACE inhibitors, improving endothelial function and repairing the endothelium, which helps lower blood pressure. Green vegetables, in particular, are highly beneficial for health and growth, as they are rich in protein, minerals, calcium, potassium, iron, and essential vitamins needed by the human body. Moreover, these nutrients play a crucial role in maintaining a healthy weight and promoting overall well-being (Slavin & Lloyd, 2012); (Siregar, 2020).

The DASH diet and a low-sodium diet exhibit distinct foci. The DASH diet emphasizes consuming vegetables, fruits, and low-fat products while reducing the intake of saturated fats. In contrast, a low-sodium diet limits sodium intake to no more than 100 mmol per day, equivalent to 2.4 g or 6 g of table salt (Astuti, 2021).

Consuming 100 grams of daily fruit and vegetables can reduce the risk of hypertension by 6% and 5% respectively. Consuming over 400 grams of fruits and vegetables daily can lead to lower blood pressure (Pradananingrum, 2022). Fruits like bananas and berries, rich in potassium and anthocyanins, and green leafy vegetables like spinach and kale, high in nitrates, also contribute to lower blood pressure (Novianti, 2022).

Tomatoes are a rich source of lycopene, a potent antioxidant with anti-inflammatory properties. Lycopene, water-insoluble and binds with fibre, is approximately 4,600 micrograms per 100 grams in red tomatoes (Fadillah, 2018). It may reduce cellular damage triggering atherosclerosis and higher blood pressure (Nugroho, 2019). Tomatoes also provide essential nutrients like 1.1 grams of fiber and 19.1 milligrams of vitamin C per 100 grams (Novianti, 2022). Potassium significantly reduces blood pressure in hypertension patients by increasing intracellular fluid concentration, reducing extracellular fluid, and promoting vasodilation, which decreases peripheral resistance and enhances cardiac output (Mafaza, 2016); (Muhamad, 2020).

CONCLUSIONS

The significance of age, body mass index (BMI), and daily consumption of fruits and vegetables are critical determinants of hypertension in the Medan community. These findings underscore the need for targeted interventions focusing on weight management and promoting a healthy lifestyle. Public health strategies should prioritize dietary modifications, remarkably increasing the intake of fruits and vegetables while emphasizing the importance of maintaining an optimal body weight. These approaches can substantially reduce the risk of hypertension, thereby contributing to improved cardiovascular health outcomes in urban populations.

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REFERENCE

Anteneh, Z. ., Yalew, W. ., & Abitew, D. . (2015). Prevalence and correlation of hypertension among adult population in Bahir Dar City, Northwest Ethiopia: a community based cross sectional study. *International Journal of General Medicine*, *8*, 175–185.

https://doi.org/https://doi.org/10.2147/IJGM.S81513

Astuti, A. P. (2021). Application of DASH diet recommendations versus low salt diet based on nutritional counselling on blood pressure reduction in hypertensive patients at the Larangan Utara health centre. *Gizi Indonesia*, *44*(1), 109-120. https://doi.org/10.36457/gizindo.v44i1.559

Bahrami, H., Sadatsafavi, M., Pourshams, A., Kamangar, F., Nouraei, M., Semnani, S., Brennan, P., Boffetta, P., & Malekzadeh, R. (2006). Obesity and hypertension in an Iranian cohort study; Iranian women experience higher rates of obesity and hypertension than American women. *BMC Public Health, 6:158*. https://doi.org/10.1186/1471-2458-6-158.

Banjarnahor, R. O. (2023). Path Analysis on the Effect of Stress, Sleep Quality, and Hypertension on Type 2 Diabetes Mellitus Incidence in the 30–60 years Age Group in Medan City. *Contagion: Scientific Periodical Journal of Public Health and Coastal Health*, *5*(4), 1169-1183. https://doi.org/10.30829/contagion.v5i4.17688

Bhise, M. ., & Patra, S. (2018). Prevalence and correlates of hypertension in Maharashtra, India: A multilevel analysis. *PloS One*, *13(2)*. https://doi.org/10.1371/journal.pone.0191948

Chaix, B., Bean, K., Leal, C., Thomas, F., Harvard, S., Evans, D., & Pannier, B. (2010). Individual/neighborhood social factors and blood pressure in the Record Cohort Study: which risk factors explain the associations? *Hypertension*, *55(3)*, 769–775. https://doi.org/10.1161/HYPERTENSIONAHA.109.143206

Chen, M. (2023). Association of body fat distribution with high blood pressure among Chinese children and adolescents with various nutritional status: a population-based study. *Journal of Public Health*, *1*(1), 1–12. https://doi.org/10.1007/s10389-023-02117-7

Erem, C., Hacihasanoglu, A., Kocak, M., Deger, O., & Topbas, M. (20008). Prevalence of prehypertension and hypertension and associated risk factors among Turkish adults: Trabzon Hypertension Study. *Journal of Public Health*, *31(1)*, 47–58. https://doi.org/10.1093/pubmed/fdn078.

Fadillah. (2018). Differences in Blood Pressure Reduction of Pre Hypertensive Elderly Given Tomato Juice (Lycopersicum grandifilum). *Jurnal Media Kesehatan*, *10*(2), 152–158. https://doi.org/10.33088/jmk.v10i2.337

Hasibuan, R. R. (2023). Factors Associated with Hypertension Control Behavior in the Pre-Elderly Group in Padangsidimpuan City. *Contagion : Scientific Periodical of Public Health and Coastal Health*, *5*(3), 811-823. https://doi.org/10.30829/contagion.v5i3.15649

Hita, I. P. A. D. (2022). Status Gizi, Tekanan Darah, Lingkar Perut, dan Kadar Asam Urat Member Senam Zumba. *Jurnal Kejaora (Kesehatan Jasmani Dan Olah Raga)*, *7*(2), 92-103. https://doi.org/10.36526/kejaora.v7i2.2064

Ikhwan. (2021). The Event of Hypertension Based on Salt, Fruit and Vegetable Consumption Habits in The Coastal Area of Belawan Sicanang. *International Archives of Medical Sciences and Public Health*, *3*(1), 86–94.

Indriyani, Y. W. I. (2020). The Effect of Chayote (Sechium edule) Administration on Blood Pressure in Pregnant Women with Hypertension in the Working Area of UPTD Puskesmas Maja, Majalengka Regency. *Journal of Midwifery Care*, *1*(1), 22–32. https://doi.org/10.34305/jmc.v1i1.191

Jiang, S., Lu, W., Zong, X., Ruan, H., & Liu, Y. (2016). Obesity and Hypertension. *Experimental and Therapetic Medicine*, *4*, 2395–2399. https://doi.org/10.3892/etm.2016.3667.

Lim, S., Vos, T., Flaxman, A., Danaei, G., Shibuya, K., Adair-Rohani, H., & Et, A. (2012). A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990-2010: a systematic analysis for the Global

Burden of Disease Study 2010. *The Lancet*, *380(9859)*, 2224–60. https://doi.org/10.1016/S0140-6736(12)61766-8.

Lima, Á. C. de S. A. (2022). Association of nutritional status with blood pressure levels of high-risk pregnant women treated in a hospital in Pernambuco, Brazil. *Rev. Bras. Pesq. Saúde*, *24*(3), 56–63. https://doi.org/10.47456/rbps.v24i3.38878

Mafaza, R. L. (2016). Analysis of the Relationship Between Abdominal Circumference, Fat Intake, and Calcium Magnesium Intake Ratio with Hypertension. *Media Gizi Indonesia*, *11*(2), 127–134. https://doi.org/10.20473/mgi.v11i2.127-134

Mc, E. C., Wilkinsion, I., & Avolio, A. (2007). Age, Hypertension, and Arterial Function.Clinical and Experimental Pharmacology and Physiology. *Wiley Online Library*, *7*, 665–671. https://doi.org/10.1111/j.1440-1681.2007.04657.x.

Ministry of Health RI. (2018). *Main results of Basic Health Research*. Health Research and Development Agency.

Muhamad. (2020). The Effect of Giving 150 Grams of Tomato (Solanum Lycopersium) on Blood Pressure of Hypertension Patients. *Borneo Nursing Journal (BNJ*, *2*(1), 55–60.

Novianti, D. P. (2022). Effect of Tomato Fruit (Solanum Lycopersicum) on Blood Pressure Reduction in Hypertensive Patients. *Student Journal of Nutrition (SJ Nutrition)*, *1*(1), 33-40. https://doi.org/10.32807/sjn.v1i1.7

Nugroho, Y. W. (2019). Effectiveness of Tomato Juice Diet to Lower Blood Pressure in Hypertension Patients in Selogiri, Wonogiri Regency. *Jurnal Keperawatan GSH*, *8*(1), 40-47.

Peltzer, K., & Pengpid, S. (2018). The Prevalence and Social Determinants of Hypertension among Adults in Indonesia: A Cross-Sectional Population Based National Survey. *International Journal of Hypertension*, *2018*. https://doi.org/https://doi.org/10.1155/2018/5610725

Pradananingrum, S. (2022). Differences in Blood Pressure After Avocado Feeding in Vegetable Farmers. *Jurnal Ilmiah Permas: Jurnal Ilmiah STIKES Kendal*, *12*(1), 81–92. https://doi.org/10.32583/pskm.v12i1.1974

Rosmiati, R. (2022). Nutritional Status, Blood Pressure Levels, and The Associated Risks for Hypertension in Islamic High School Teachers in Medan. *ACEIVE 2022: Proceedings of the 4th Annual Conference of Engineering and Implementation on Vocational Education*, 1–10. https://doi.org/10.4108/eai.20-10-2022.2328873

Sammeng, W. (2021). Nutritional Status, Blood Pressure and Blood Glucose Levels in Participants of Taklim Assembly in Ambon City. *Gorontalo Journal Of Nutrition And Dietetic*, *1*(2), 82–88. https://doi.org/10.32662/gjnd.v1i2.1750.

Siregar, P. A. (2020). Physical Activity, Salty Food Consumption and Hypertension Incidence in Coastal Communities of Medan City. *Jurnal Ilmiah Kesehatan*, *2*(1), 1-8. https://doi.org/10.36590/jika.v2i1.34

Slavin, J. L., & Lloyd, B. (2012). Health Benefits of Fruits and Vegetables. *American Society for Nutrition*, *3*, 506– 516. https://doi.org/10.3945/an.112.002154

Susanti, N. (2020). Determinants of Hypertension in Coastal Communities Based on Socio-Demographic Conditions and Food Consumption. *Jurnal Ilmiah Kesehatan*, *2*(1), 43-52. https://doi.org/10.36590/jika.v2i1.52

Tarigan, A. R. (2021). Analysis of Family Support and Diet Compliance in Hypertension Patients. *Contagion : Scientific Periodical of Public Health and Coastal Health*, *3*(1), 16–28. https://doi.org/10.30829/contagion.v3i1.9123