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ORIGINAL ARTICLE

RISK FACTORS OF HYPERTENSION IN PREGNANT WOMEN IN LABUHANBATU REGENCY: A CROSS−SECTIONAL STUDY

Faktor Risiko Hipertensi Pada Ibu Hamil di Kabupaten Labuhanbatu

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ABSTRACT

Background: Pregnant women with hypertension face elevated risks of complications, including preeclampsia and maternal mortality. Despite the increasing prevalence of gestational hypertension and its associated burdens, limited research—particularly at the local level—hinders effective prevention and management strategies. **Purpose**: This research aimed to investigate the risk factors associated with hypertension in pregnant women in Labuhan Batu Regency. **Methods**: This cross-sectional study involved 80 pregnant women from Labuhanbatu Regency, North Sumatra, Indonesia. Data on obesity, age, physical activity, and secondhand smoke exposure were collected through measurements and questionnaires. Obesity was assessed using mid-upper arm circumference (MUAC), while other variables were determined through interviews. Data were analyzed descriptively, and Fisher's exact test was employed to compare risk factors between hypertensive and non-hypertensive pregnant women. **Results**: Obesity (p=0.29) and age (p=0.84) were not significantly associated with hypertension. However, pregnant women with light physical activity had a lower risk of hypertension compared to those with heavy physical activity (p=0.02). There was no significant association between exposure to cigarette smoke and hypertension (p=0.20). **Conclusion**: The findings suggest that light physical activity might be protective against hypertension during pregnancy among homemakers in Labuhanbatu regency.

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ABSTRAK

Latar Belakang: *Ibu hamil dengan hipertensi menghadapi risiko komplikasi yang lebih tinggi, termasuk preeklamsia dan kematian ibu. Meskipun prevalensi hipertensi gestasional dan beban terkaitnya meningkat, penelitian yang terbatas—terutama di tingkat lokal—menghambat strategi pencegahan dan penanganan yang efektif.*. ***Tujuan:*** *Penelitian ini bertujuan untuk menyelidiki faktor risiko yang berhubungan dengan hipertensi pada ibu hamil di Kabupaten Labuhan Batu.* ***Metode:*** *Penelitian cross-sectional ini melibatkan 80 ibu hamil dari Kabupaten Labuhanbatu, Sumatera Utara, Indonesia. Data tentang obesitas, usia, aktivitas fisik, dan paparan asap rokok dikumpulkan melalui pengukuran dan kuesioner. Obesitas dinilai menggunakan lingkar lengan atas (LILA), sementara variabel lain ditentukan melalui wawancara. Data dianalisis secara deskriptif, dan uji pasti Fisher digunakan untuk membandingkan faktor risiko antara ibu hamil hipertensi dan non-hipertensi.* ***Hasil:*** *Obesitas (p=0,29) dan usia (p=0,84) tidak berhubungan secara signifikan dengan hipertensi. Namun, ibu hamil yang melakukan aktivitas fisik ringan memiliki risiko hipertensi yang lebih rendah dibandingkan dengan ibu hamil yang melakukan aktivitas fisik berat (p=0,02). Tidak terdapat hubungan yang signifikan antara paparan asap rokok dengan hipertensi (p=0,20).* ***Simpulan:*** *Hasil penelitian menunjukkan bahwa aktivitas fisik ringan dapat memberikan perlindungan terhadap hipertensi selama kehamilan di kalangan ibu rumah tangga di Kabupaten Labuhanbatu.*

INTRODUCTION

Pregnant women represent a vulnerable population for hypertension, particularly during pregnancy. Hypertension is a common complication of pregnancy, with a prevalence rate ranging from 5% to 15%, and both mortality and morbidity associated with hypertension during pregnancy remain significant among pregnant women (1). Globally, 14.30% of pregnant women experience hypertension, with 43.3% reporting no blood pressure measurements in the past year (2). In Indonesia, the reported prevalence is 3.85% among pregnant women (3). Awareness, treatment, and control of hypertension are notably low in Indonesia; only 42.90% of those with hypertension are aware of their condition, 11.5% receive treatment, and 14.30% achieve controlled blood pressure (4).

Hypertensive disorders complicate approximately 10% of pregnancies and include chronic hypertension, gestational hypertension, preeclampsia, and eclampsia (5). These conditions are associated with increased maternal and fetal morbidity and mortality, including risks of stroke, seizures, organ failure, and perinatal death (6,7). Hypertensive disorders significantly impact birth outcomes, increasing the risk of low birth weight, preterm births, and small-for-gestational-age infants (8,9). Diagnostic tools such as ambulatory blood pressure monitoring, uterine artery Doppler ultrasound, and serum biomarkers can aid in early detection and management. Therefore, improved screening, prevention, and treatment strategies are crucial for optimizing both short- and long-term maternal and fetal outcomes (5).

Research indicates that pregnant women with a history of hypertension are at a greater risk of developing preeclampsia compared to those without such a history (10). The primary causes of maternal mortality in Indonesia include postpartum haemorrhage, hypertension during pregnancy, and infection (11). Studies conducted in Ethiopia have identified several risk factors associated with hypertension during pregnancy, including rural residence, low fruit consumption, twin pregnancies, gestational diabetes mellitus, and pre-pregnancy overweight status (12). Another study highlighted additional risk factors such as primiparity (first-time mothers), nulliparity (women who have never given birth), history of abortion, lack of follow-up antenatal care, previous hypertension history, and positive diabetes mellitus history (13). Furthermore, research indicates a rapid increase in the prevalence of hypertension among pregnant women in Southeast Asia over the past two decades.

Commonly identified factors include ethnicity, educational level, socioeconomic status, body mass index (BMI), waist circumference, smoking habits, and dyslipidemia (14).

In Indonesia specifically, various studies have reported numerous risk factors for hypertension during pregnancy. Genetic factors, race and ethnicity, obesity, maternal age, and the number of children born influence the causes (15). Obesity and advanced maternal age are the most prevalent risk factors for hypertension. Excess weight or obesity increases circulating blood volume through blood vessels while elevating heart workload and blood pressure (16). Additionally, knowledge about health risks, physical activity levels, exposure to cigarette smoke, parity (number of births), autoimmune diseases, and family history of hypertension also contribute to the risk (17).

A review of regular reports from the Labuhanbatu District Health Office revealed that there were 189 cases of gestational hypertension among a total of 11,561 pregnant women in April 2023. Although the prevalence of hypertension among pregnant women is relatively low in this region, there is currently no specific strategy to minimize its incidence. This information was gathered from initial interviews with officers responsible for maternal and child health programs at several community health centres (puskesmas). Moreover, research examining risk factors for gestational hypertension in Labuhanbatu Regency remains limited. This knowledge gap hinders the development of targeted interventions; therefore, a comprehensive study to identify these key risk factors is essential. The expected outcome of such research is to provide valuable data that can inform policymakers in designing and implementing specific interventions. The objective of this study was to identify the key risk factors linked to hypertension among pregnant women in Labuhanbatu Regency.

METHODS

This quantitative study employed a cross-sectional design to examine the risk factors associated with hypertension among pregnant women. The research was conducted in Labuhanbatu Regency, North Sumatra Province, Indonesia, from June to July 2023. Initially, 189 pregnant women were contacted to participate in the study. However, after follow-up, 37 participants were found to have relocated to different regencies or cities, leaving 152 potential subjects. The sample was determined using a purposive sampling technique based on the inclusion criteria of pregnant women who were willing to participate in their second or third trimester. Ultimately, only 80 women agreed to participate and signed informed consent forms. During the sample tracing process, the researcher was assisted by health centre staff and village midwives in each area.

Data for this study were collected using several methods. Maternal obesity data were obtained by measuring upper arm circumference using a mid-upper arm circumference (MUAC)/LILA tape. MUAC was categorized as ≥ 23.5-28.5 (Obesity) and <28.5 (Normal). The researcher then provided a questionnaire for the respondents to complete. Age data were collected through direct interviews with pregnant women using a questionnaire, categorized as ≥ 40 years (at risk) and <40 years (not at risk). Information on physical activity was also gathered through interviews with pregnant women using a prepared questionnaire, with physical activity categorized as light physical activity (3.5-7 kcal/min) and heavy physical activity (>7 kcal/min). Finally, data on exposure to secondhand smoke were collected similarly through direct interviews with pregnant women to obtain information about their exposure to secondhand smoke. They were categorized into two groups: exposed to secondhand smoke and not exposed.

Data from this study were analyzed descriptively to determine the frequency distribution of obesity, age, physical activity, exposure to cigarette smoke, and hypertension. All results were presented as percentages and in table form. Additionally, a bivariate analysis was conducted to compare the case and control groups regarding obesity, age, physical activity, and exposure to cigarette smoke concerning hypertension in pregnant women, using Fisher's exact test at a significance level of 0.05. All research data were processed using SPSS v.26. This study has obtained ethical approval from the Ethics Commission of Health Research at Universitas Prima Indonesia (080/KEPK/UNPRI/X/2023).

RESULTS

Table 1 presents the distribution of occupational frequency, obesity status, age, physical activity levels, and exposure to cigarette smoke among the study participants, all housewives. Most participants (96.25%) were not classified as obese, with a LILA score of less than 28,5. Slightly over half of the participants (52.50%) were aged 40 or older, placing them in a higher risk category. An overwhelming majority (98.75%)

reported engaging in heavy physical activity, defined as more than 7 kcal/min. A large proportion (95%) of participants indicated exposure to cigarette smoke.

Table 2 examines the relationship between several variables and hypertension in pregnant women. While most comparisons did not reach statistical significance, some trends are notable. Regarding obesity, measured by upper arm circumference (LILA), nearly all participants, both obese (LILA ≥ 23,5-28,5) and non-obese (LILA <28,5), presented with hypertension (92.86% and 100%, respectively). However, this difference was not statistically significant (p=0.29). Similarly, advanced maternal age (≥40 years) was not significantly associated with hypertension (p=0.84), although the single participant in the at-risk group did exhibit hypertension.

Physical activity showed a statistically significant association with hypertension (p=0.02). The majority of women engaging in light physical activity (3,5-7 kcal/min) had hypertension (97.37%), while a smaller proportion of those engaging in heavy activity (>7 kcal/min) had hypertension (75%).

Exposure to cigarette smoke also did not demonstrate a statistically significant association with hypertension (p=0.208). Among those exposed to smoke, 94.34% had hypertension, compared to 100% of those not exposed. In summary, while the data suggests possible trends related to physical activity and potentially obesity and smoking, only the association with physical activity reached statistical significance.

Table 1

Distribution Of Frequency of Occupation, Hypertension, Obesity, Age, Physical Activity, and Exposure To Cigarette Smoke

Characteristic	n	%
Occupation		
Housewife	80	100
Working	0	0
Obesity		
Obesity (LILA ≥23,5-28,5)	3	3.75
Non-Obese (LILA <28,5)	77	96.25
Age		
At-Risk (≥40 years)	42	52.50
No-Risk (<40 years)	38	47.50
Physical Activity		
Light (3,5-7kcal/min	1	1.25
Heavy (>7kcal/min)	79	98.75
Smoke Exposure		
Yes	76	95
No	4	5
Hypertension		
Yes	77	96.25
No	3	3.75

Table 2
The Relationship Between Obesity, Age, Physical Activity, Exposure to Cigarette Smoke, and Hypertension in Pregnant Women

Variables	Hypertension				Total		p-value
	Yes		No				
	n	%	n	%	n	%	
Obesity							
Obesity (LILA ≥23,5-28,5)	39	92.86	3	7.14	42	100.00	0.29
Non-Obese (LILA <28,5)	38	100.00	0	0.00	38	100.00	
Age							
At-Risk (≥40 years)	1	100.00	0	0.00	1	100.00	0.84
No-Risk (<40 years)	76	96.20	3	3.80	79	100.00	
Physical Activity							
Light (3,5-7kkal/min)	74	97.37	2	2.63	76	100.00	0.02
Heavy (>7kkal/min)	3	75.00	1	25.00	4	100.00	
Smoke Exposure							
Yes	50	94.34	3	5.66	53	100.00	0.20
No	27	100.00	0	0.00	27	100.00	

DISCUSSION

The results of the study indicate that physical activity is a risk factor for hypertension in pregnant women. This study observed a lack of physical activity among pregnant women. The weight of the fetus often reduces the level of physical activity, leading to higher heart rates. Some respondents also reported increased sleep frequency during pregnancy, such as sleeping for extended periods in the morning; however, this did not result in hypertension in pregnant women. The light physical activity among most pregnant women, primarily housewives, involves routine household chores such as preparing food, shopping, and laundry. Physical activity can reduce blood pressure through systemic vascular resistance, sympathetic activity, plasma renin activity, homeostasis model assessment, insulin resistance index, body weight, and abdominal circumference while improving blood lipid profiles (18). Lack of physical activity can compromise the body's organs and blood and oxygen supply, leading to health problems such as high body weight and increased blood pressure (19).

The results of the study indicate that obesity is not a risk factor for hypertension in pregnant women. This condition is likely due to pregnant women's mindfulness regarding their diet during pregnancy, as recommended by local midwives. Weight gain during pregnancy is a normal condition experienced by pregnant women; however, they continue to consume food to gain weight according to guidelines. Obesity negatively impacts both the mother and the fetus during pregnancy, childbirth, and postpartum. One impact is that the mother is at risk of developing chronic hypertension due to obesity, which places excessive strain on the heart and increases pressure on blood vessels due to fat thickness.

Additionally, the likelihood of the mother developing diabetes increases as beta human chorionic gonadotropin (HCG) converts most body fat into glucose. A high body mass index represents a nutritional problem caused by excess calories, sugar, and salt, which can be risk factors for various degenerative diseases such as hypertension related to excess fat accumulation in the body (obesity). Pre-pregnancy weight and weight gain during pregnancy require special attention because they can affect fetal growth and development and increase the risk of pregnancy complications such as diabetes and preeclampsia (20). Many factors can cause hypertension during pregnancy, including race or ethnicity, hereditary history, obesity, behaviour, stress, smoking, alcohol consumption, salt consumption, maternal age, and the number of children born by the mother (21,22).

This study aligns with previous research that found no significant relationship between obesity and the incidence of hypertension in pregnant women (p=0.66) (23). Weight gain during pregnancy is mainly due to the uterus and its contents, breasts, increased blood volume, and extravascular fluid. The study also corresponds with Sundari and Bangsawan (24) research, which found no significant relationship between obesity and the incidence of hypertension in pregnant

women (p=1.93). The researchers suggested that there is no relationship between obesity and hypertension incidence. The analysis showed that the proportion of hypertensive patients who are not obese is higher than that of hypertensive patients who are obese; additionally, non-obese individuals already tend to suffer from hypertension.

The results of this study indicate that age is not a risk factor for hypertension in pregnant women. Age is a critical component of reproductive status, influencing bodily functions and significantly impacting health status. One cause of maternal mortality is maternal age; the safest age for pregnancy and childbirth is between 20-30 years. One factor causing hypertension during pregnancy is maternal age; those under 20 or over 35 years old are at a higher risk compared to pregnant women aged 20-30 years. Arteries become wider and stiffer as age increases (25). This reduces capacity and recoil through blood vessels while increasing systolic pressure. Aging also disrupts neurohormonal mechanisms such as the renin-angiotensin-aldosterone system; it increases peripheral plasma concentrations, leading to glomerulosclerosis and intestinal fibrosis. Increased vasoconstriction and vascular resistance contribute to hypertension.

However, this theory contradicts this study's findings. Individuals aged 20-35 are considered high-risk; however, those who do not develop hypertension typically have good maternal health status without a prior history of hypertension and regularly undergo ANC examinations (26). Conversely, individuals aged 20-35 considered not at risk may still experience hypertension often due to it being their first pregnancy, which can increase blood pressure. This study is also supported by Radjamuda and Montolalu (20) findings, which indicated that the age group under 20 years experienced a higher incidence of pregnancy-related hypertension (30%) compared to age groups 20-30 years (7.20%) and over 35 years (18.40%). Age determines health; if a pregnant woman is under 20 or over 35 years old, risks increase significantly (27).

The results of this study align with Indah et al (28) research, indicating an insignificant relationship between physical activity and hypertension in pregnant women (p=0.42). This study found that physical activity in pregnant women has no relationship with hypertension; therefore, lacking physical activity does not necessarily cause hypertension in pregnant women, nor does sufficient physical activity guarantee prevention against it during pregnancy. In addition to physical activity, many other risk factors contribute to hypertension in pregnancy. Another study by Hasanudin et al (29) found a significant relationship with a p-value of 0.05, suggesting that physical activity influences blood pressure stability; more frequent engagement in physical activity correlates with lower risks of developing hypertension. Additionally, being overweight or obese can increase this risk.

The study results indicate that there is no significant relationship between exposure to cigarette smoke and the incidence of hypertension in pregnant women. In this study, respondents' husbands were quite knowledgeable about health risks associated with cigarette smoke for both mothers and fetuses, potentially causing maternal hypertension along with conditions like stunting or low birth weight in babies; therefore, husbands smoked outside or away from pregnant women's reach. The researcher assumes that family knowledge and support are preventive measures against hypertension.

Smoking behaviour inside homes affects passive smokers because active smokers release smoke from their mouths along with burning cigarettes, causing smoke diffusion within confined spaces where clean air cannot be exchanged directly; thus, smoke settles within rooms adhering to walls inhaled subsequently by passive smokers (30).

Research Limitations

This study presents several limitations. The study population consisted exclusively of homemakers, which restricts the generalizability of the findings to other pregnant populations, such as those who are employed or come from differing socioeconomic backgrounds. Occupational and socioeconomic factors can influence health behaviours and access to healthcare, which, in turn, can affect hypertension risk. Secondly, this study relied on self-reported data for physical activity and exposure to tobacco smoke. Self-reporting is susceptible to recall bias and social desirability bias, potentially affecting data accuracy. Objective measures of physical activity, such as accelerometers, along with biochemical verification of tobacco smoke exposure, would provide more robust data. Thirdly, this study considered only a limited number of hypertension risk factors. Other potentially contributing factors, such as dietary habits, family history of hypertension, pre-existing medical conditions, and stress levels, were not

assessed. Including these factors in the analysis could provide a more comprehensive understanding of the determinants of hypertension in this population.

Further research is recommended to address these limitations. Larger-scale studies with more diverse populations—including women with varying occupations and socioeconomic backgrounds—are needed to confirm the findings and enhance generalizability. Future studies should also incorporate objective measures of physical activity and tobacco smoke exposure while considering a wider range of potential risk factors for hypertension. Longitudinal studies that follow pregnant women over time could provide valuable insights into the development of hypertension and the impact of various risk factors. Finally, qualitative research exploring the lived experiences of pregnant women with hypertension in Labuhanbatu Regency could provide valuable contextual information and inform the development of culturally appropriate interventions.

CONCLUSION

This study aimed to identify the risk factors for hypertension in pregnant women residing in Labuhanbatu Regency. Although obesity and maternal age were not significant predictors of hypertension, the findings indicate a protective effect of light physical activity against gestational hypertension. While exposure to second-hand smoke was not identified as a significant predictor, further research with a larger sample size is necessary to confirm these findings and investigate other potential risk factors. These results suggest that promoting light physical activity among pregnant women in Labuhanbatu Regency could effectively reduce the incidence of hypertension during pregnancy. Additional research with a larger sample size is warranted to validate these findings and examine other potential risk factors for hypertension in this population.

CONFLICT OF INTEREST

The authors declare that they have no competing interests.

AUTHOR CONTRIBUTIONS

H and PM held primary responsibility for the research, contributing to its conceptualization, writing, and overall project management. Meanwhile, DNJ, MS, and MJN concentrated on data analysis and interpretation, enhancing the research through data curation, formal analysis, and writing.

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REFERENCES

1. Yuriah S, Kartini F. Factors affecting with the prevalence of hypertension in pregnancy: scoping review. PLACENTUM J Ilm Kesehat dan Apl. 2022;10(1):1.
2. Bowen L, Stevens RJ, Schutte AE, Beaney T, Poulter NR, McManus RJ, et al. Global blood pressure screening during and after pregnancy: may measurement month 2019. Hypertension. 2024 Nov;81(11):2298–306.
3. Putripratama AA, Sofiain Y, Roesli RMA. A17877 Epidemiology of hypertension in Indonesian women, IFLS 5 Data. J Hypertens. 2018 Oct;36:e343.
4. Peltzer K, Pengpid S. The prevalence and social determinants of hypertension among adults in Indonesia: A cross-sectional population-based national survey. Int J Hypertens. 2018 Aug;2018:1–9.
5. Antza C, Cifkova R, Kotsis V. Hypertensive complications of pregnancy: A clinical overview. Metabolism. 2018 Sep;86:102–11.
6. Bajpai D, Popa C, Verma P, Dumanski S, Shah S. Evaluation and management of hypertensive disorders of pregnancy. Kidney360. 2023 Oct;4(10):1512–25.
7. Cífková R. Hypertension in pregnancy: A diagnostic and therapeutic overview. High Blood Press Cardiovasc Prev. 2023 Jun;30(4):289–303.
8. Irwinda R, Santoso BI, Surya R, Nembo LF. Risk of small for gestational age babies in preterm delivery due to pregnancy-induced hypertension. Med J Indones. 2019 May;28(1):57–62.
9. Ushida T, Kotani T, Kinoshita F, Imai K, Nakano-Kobayashi T, Nakamura N, et al. Maternal low birth weight and hypertensive disorders of pregnancy. Pregnancy Hypertens. 2021 Mar;23:5–10.
10. Bancin LJ, Hasibuan FM, Elisa E, Maha EA. Maternal mortality trends in North Sumatra

Province 2018–2020. J Prima Med Sains. 2023;5(1):1–11.
11. Ibrahim T, Ridwan A D. Determinants of maternal and neonatal mortality in Indonesia. J Kedokterean Nanggroe Med. 2022;5(938):43–8.
12. Kahsay HB, Gashe FE, Ayele WM. Risk factors for hypertensive disorders of pregnancy among mothers in Tigray region, Ethiopia: matched case-control study. BMC Pregnancy Childbirth. 2018 Dec;18(1):482.
13. Hinkosa L, Tamene A, Gebeyehu N. Risk factors associated with hypertensive disorders in pregnancy in Nekemte referral hospital, from July 2015 to June 2017, Ethiopia: Case-control study. BMC Pregnancy Childbirth. 2020 Dec;20(1):16.
14. Mohammed Nawi A, Mohammad Z, Jetly K, Abd Razak MA, Ramli NS, Wan Ibadullah WAH, et al. The prevalence and risk factors of hypertension among the urban population in Southeast Asian countries: a systematic review and meta-analysis. Salvetti M, editor. Int J Hypertens. 2021 Feb;2021(1):1–14.
15. Zakiah. Factors that influence the occurrence of hypertension in pregnant women at the Siti Fatimah Special Regional Hospital for Women and Children, Makassar. J Adm Rumah Sakit. 2020;2(1).
16. Tiara UI. The relationship between obesity and the incidence of hypertension. J Heal Sci Physiother. 2020;2(2):167–71.
17. Hernida I, Hasanudin Nuru, Darmawansyah. Factors related to hypertension in pregnancy in the working area of Padang Tepong Health Center, Ulu Musi District, Empat Lawang Regency. J Kebidanan Manna. 2022;1(2):75–88.
18. Firdaus M, Suryaningrat WC. The relationship between diet and physical activity and blood pressure in hypertensive patients in Kapuas. Maj Kesehat. 2020;7(2):110–7.
19. Siregar PA, Simanjuntak SFS, Ginting FHB, Tarigan S, Hanum S, Utami FS. Physical activity, consumption of salty foods and the occurrence of hypertension in coastal communities in Medan city. J Ilm Kesehat. 2020;2(1):1–8.
20. Radjamuda N, Montolalu A. Risk factors associated with the occurrence of hypertension in pregnant women at the Obstetrics and Gynecology Polyclinic, Prof. Dr. V. L. Ratumbuysang Mental Hospital, Manado City. J Ilm Bidan. 2014;2(1):33–40.
21. Marlina Y, Santoso H, Sirait A. Factors related to hypertension in pregnant women in the working area of Padang Panyang Health Center, Kuala Pesisir District, Nagan Raya Regency. J Healthc Technol Med [Internet]. 2021;7(2):1512–25.
22. Wiranto W, Putriningtyas ND. Risk factors for hypertension in pregnant women. Ijphn. 2021;1(3):759–67.
23. Hirooka-Nakama J, Enomoto K, Sakamaki K, Kurasawa K, Miyagi E, Aoki S. Optimal weight gain in obese and overweight pregnant Japanese women. Endocr J. 2018;65(5):557–67.
24. Sundari L, Bangsawan M. The role of blood viscosity in acute ischemic stroke. J Keperawatan. 2015;XI(2):216–23.
25. Nuraeni E. Correlation of age and gender risk with the event of hypertension at Clinic X, Tangerang City. J JKFT. 2019;4(1):1–6.
26. Syam AN, Tihardimanto A, Azis AA, Sari JI, Maidina S. Factors related to the occurrence of hypertension in pregnant women. Ibnu Sina J Kedokt dan Kesehat. 2023;22(1):29–37.
27. Rahmadini AF, Lestari F, Nurjanah I, Iklimah I, Salsabila S. Factors that cause hypertension in pregnant women. J Public Heal Innov. 2023;3(02):205–13.
28. Fitri IU, Kamsatun, Kusniasih S, Sakti B. Physical Activity of Pregnant Women on the Incidence of Hypertension in Pregnancy. J Keperawatan Indones Florence Nightingale. 2024;4(1):42–8.
29. Hasanudin, Adriyani VM, Perwiraningtyas P. The relationship between physical activity and blood pressure in people with hypertension in the Tlogosuryo area, Tlogomas sub-district, Lowokwaru district, Malang city.. J Nurs News. 2018;3(1):787–99.
30. Syahraeni, Hengky HK, Rusman ADP. The effect of cigarette smoke exposure at home in women on the incidence of hypertension in the working area of the Madisingna Mario Health Center, Parepare City. J Ilm Mns Dan Kesehat. 2022 May;5(2):199–207.