

The impact of cigarette smoke as a risk factor for hypertension in pregnancy

Trimaya Cahya Mulat^{1*}, Jianing Wang², Asridawati Akib³

¹Department of Nursing, Politeknik Sandi Karsa, South Sulawesi, Indonesia

²School of Public Health, Tongji Medical College, Huazhong University of Science and Technology, Wuhan, China

³Department of Midwifery, Politeknik Sandi Karsa, South Sulawesi, Indonesia

*Correspondence: Trimaya Cahya Mulat, Department of Nursing, Politeknik Sandi Karsa, South Sulawesi, Indonesia. Email: trimayacm11@gmail.com

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ABSTRACT

Introduction: Hypertension in pregnancy is one of the severe complications and is the leading cause of maternal and perinatal morbidity and mortality. Risk factors for hypertension in pregnancy include various aspects, including exposure to cigarette smoke, which has a detrimental impact on the mother and fetus. This study aims to analyze the impact of exposure to cigarette smoke as a risk factor for hypertension in pregnancy.

Methods: The design of observational analytical research with a cross-sectional design uses point-time, observation, or data collection methods to examine the relationship dynamics between impact risk factors. The dependent variable of this study is the prevalence of hypertension in pregnant women. The number of samples was 128 people using the purposive sampling technique.

Results: The results of the study showed that pregnant women who were exposed to cigarette smoke, both active and passive, had a higher risk of developing hypertension compared to mothers who were not exposed. Harmful components in cigarette smoke, such as nicotine and carbon monoxide, play a role in raising blood pressure through vasoconstriction mechanisms and oxidative stress, which aggravate the workload of the heart and circulatory system.

Conclusions: These findings show the need for prevention and education efforts to reduce exposure to cigarette smoke in pregnant women, to reduce the incidence of hypertension in pregnancy, and improve the health of mothers and babies. With this information, it is hoped that health workers and the public can be more aware of the dangers of cigarette smoke during pregnancy and strive for a smoke-free environment for pregnant women.

Keywords: cigarette smoke, hypertension, pregnancy.



INTRODUCTION

Hypertension in pregnancy is one of the complications that often occur and can have a serious impact on the mother and fetus. This condition is even one of the leading causes of maternal morbidity and mortality worldwide, especially in developing countries that have limited access to adequate health care (Bloodworth et al., [2024](#)). Hypertension during pregnancy not only harms the mother but also impacts fetal development, which can lead to complications such as preeclampsia, premature birth, and low birth weight (Burden et al., [2023](#)). Various risk factors have been identified as the cause of hypertension in pregnancy, and one that has received special attention is exposure to cigarette smoke. Hypertension in pregnancy is the leading cause of maternal and perinatal morbidity and mortality worldwide. According to data from the World Health Organization (WHO), gestational hypertension contributes to about 14% of maternal deaths and is a major risk factor for premature birth, low birth weight, and stunted fetal growth. Therefore, the identification and management of hypertension risk factors in pregnancy is a priority in efforts to improve maternal and child health. Pregnancy is a critical period characterized by significant physiological and hormonal changes in a woman's life. During this time, the health of pregnant women becomes an essential factor that affects the mother's well-being and the fetus's development and health (Abdelwahab et al., [2024](#)). One of the most common and serious complications during pregnancy is gestational hypertension, which includes a variety of conditions such as preeclampsia, eclampsia, and chronic hypertension that develops or worsens during pregnancy (Ekblad et al., [2024](#)).

One of the risk factors that is getting more attention is exposure to cigarette smoke, both actively and passively. Cigarette smoke contains more than 7,000 chemicals, including carcinogenic and toxic substances such as nicotine, carbon monoxide, and tar. Exposure to these substances has been shown to have a variety of adverse effects on the cardiovascular system, including increased blood pressure and damage to blood vessels. In pregnant women, exposure to secondhand smoke can worsen existing hypertensive conditions or increase the risk of developing new hypertension during pregnancy (Campbell et al., [2023](#)). Cigarette smoke, both from active and passive smokers, contains several harmful substances, such as nicotine, carbon monoxide, and various other carcinogenic substances that can interfere with the cardiovascular system. Nicotine can cause vasoconstriction, which is a narrowing of blood vessels, increasing blood pressure (Ali et al., [2023](#)).

Meanwhile, the carbon monoxide in cigarette smoke reduces the blood's capacity to carry oxygen, which makes the heart work harder and increases the risk of hypertension (Wijayanti et al., [2023](#)). Exposure to cigarette smoke in pregnant women not only endangers the health of the mother but can also affect the health of the developing fetus. Various studies have shown that exposure to cigarette smoke can inhibit blood flow to the placenta, thereby reducing the supply of nutrients and oxygen essential for fetal growth. Exposure to cigarette smoke, both actively and passively, significantly increases the risk of hypertension in pregnant women (Li et al., [2024](#)). Cigarette smoke contains harmful substances such as nicotine, carbon monoxide, and other toxic substances that can cause vasoconstriction and oxidative stress, two mechanisms that have a direct impact on increased blood pressure. This endangers the health of the mother and fetus and can lead to serious complications such as preeclampsia, premature birth, and low birth weight (McCarthy et al., [2024](#)).

The problem raised in this study is how cigarette smoke plays a role as the leading risk factor for hypertension in pregnancy and the impact it has on the health of the mother and fetus (Rahnamaei et al., [2024](#)). Exposure to secondhand smoke in pregnant women often occurs in the household or workplace environment, especially when there are family members or co-workers who smoke. Although the impact of secondhand smoke on cardiovascular disease has been extensively studied, the specific link between secondhand smoke exposure and hypertension in pregnancy still needs more research. Moreover, pregnant women who do not smoke but are exposed to cigarette smoke (passive smokers) are often unaware of the risks they face, so

preventive measures in the family and community environment have not been maximized. Preventive measures are very important to protect pregnant women from exposure to cigarette smoke. Interventions such as health education about the dangers of secondhand smoke during pregnancy, smoke-free environmental policies in public places, and raising awareness of families and the community are effective measures to reduce these risks. In addition, the role of medical personnel is very important in providing information and supporting pregnant women to avoid exposure to cigarette smoke to maintain the health of mothers and babies.

The novelty or novelty in this study lies in efforts to explore the impact of cigarette smoke, specifically as a risk factor for hypertension in pregnancy among pregnant women who are exposed to secondhand smoke. This study focuses on an aspect that is often overlooked, namely the effect of indirect exposure to cigarette smoke on increasing blood pressure in pregnant women. Thus, the results of this study are expected to make a significant contribution to maternal and child health, as well as provide a basis for health policies to reduce exposure to cigarette smoke in pregnant women. Through this study, it is also hoped that the understanding of the dangers of cigarette smoke for pregnant women can increase, thereby encouraging the implementation of a smoke-free environment, both at home and at work, as well as strengthening public awareness of the importance of maintaining the health of mothers and fetuses from the dangers of exposure to cigarette smoke.

MATERIALS AND METHODS

Research Design

This type of research is observational analysis with a cross-sectional design using point-time, observation, or data collection methods to examine the relationship dynamics between impact risk factors. This research was conducted from August to September 2024. A population of 187 pregnant women in the working area of the health center with a gestational age of more than 20 weeks was the research sample.

Population and Sample

The sampling technique in this study used Purposive Sampling using the Slovin formula; the sample size in the study was 128 people, with inclusion criteria: pregnant women with a gestational age of >20 weeks and Willing to be respondents to fill out the questionnaire. Exclusion Criteria: hearing loss, limitations in reading and writing, and pregnant women who are not willing to be respondents.

Data Collection

In this study, the PASS (Perinatal Anxiety Screening Scale) questionnaire instrument was used to measure anxiety in pregnant women; a questionnaire that asked about the mother's age, gestational age, exposure to cigarette smoke around the place of residence, as well as history of hypertension of pregnant women, and blood pressure checks in pregnant women using a sphygmomanometer. The data collection process includes a questionnaire approach, where a list of questions related to the research is made first and sent to the respondents directly to be filled in according to the questionnaire instructions or the researcher's instructions.

Research Instruments

Cigarette smoke exposure questionnaire. This questionnaire aims to collect information about exposure to cigarette smoke, both actively and passively. This questionnaire can include the frequency of exposure, duration, type of cigarette, and location of exposure (such as at home, work, or public places). Questions about lifestyle, such as physical activity, diet, and alcohol use, may also be included to control for other variables that may affect hypertension. Sphygmomanometer (Blood Pressure Measuring Device). Blood pressure measurement is the main instrument in determining the status of hypertension in pregnant women. The sphygmomanometer used must be medically validated and have the appropriate standards for pregnant women. Blood pressure measurements can be done at the beginning of pregnancy as preliminary data and monitored periodically until the last trimester. Medical record data of pregnant women is very important to know the mother's health history, including a history of hypertension or previous cardiovascular disease, as well as other pregnancy complications. These

medical records can also provide information about relevant laboratory results, such as nicotine or cotinine levels in the blood, indicating exposure to secondhand smoke.

Data Analysis

The collected data will be cleaned using SPSS before descriptive and analytical analysis. The data obtained was processed using SPSS. The data analysis in this study was conducted using univariate and bivariate analysis.

Research Ethics

This research has received ethical approval from the University Research Ethics Committee with Number B-335/P19/KE/IX/2024. Each participant was explained the research objectives and procedures and the guarantee of confidentiality of their data. Participants are also free to resign at any time if they feel uncomfortable.

RESULTS

Table 1. Research variables

Hypertension in pregnant women	Frequency	Percentage
No pregnancy hypertension > 20 Weeks (< 140/90 mmHg)	30	23,4
Pregnancy hypertension > 20 Weeks (> 140/90 mmHg)	98	76,6
Age of respondents		
Age of the Mother Not at Risk (> 20 Years and < 35 Years)	79	61,7
Age of Pregnant Women at Risk (< 20 Years and > 25 Years)	49	38,3
History of hypertension		
Pregnant women at 20 weeks have no history of hypertension	90	70,3
Pregnant women at 20 weeks have a history of hypertension	38	29,7
Exposure to cigarette smoke		
Pregnant women are in a smoke-free environment	22	17,2
Pregnant women are in an active/passive smoking environment	106	82,8

Table 1. shows the results of the study on hypertension in pregnant women with the most data, namely hypertension > 20 weeks (> 140/90 mmHg) as many as 98 respondents (76.6%), and the smallest data, namely no hypertension > 20 weeks (> 140/90 mmHg) as many as 30 respondents (23.4%).

Table 2. Bivariate analysis describes the results of statistical tests between independent variables

Age of respondents	Hypertension in Pregnant Women				Total	%	p Value
	No pregnancy hypertension		Pregnancy hypertension				
	F	%	F	%			
Mother's age is not at risk	24	18,7	55	43	79	61,7	0,019
Age of pregnant women at risk	6	4,7	43	33,6	49	38,3	
History of hypertension							
Pregnant women at 20 weeks have no history of hypertension	28	21,9	62	48,4	90	70,3	0,002
Pregnant women at 20 weeks have a history of hypertension	2	1,6	36	28,1	38	29,7	
Exposure to cigarette smoke							
Pregnant women are in a smoke-free environment	12	9,4	10	7,8	22	17,2	0,000
Pregnant women are in an active/passive smoking environment	18	14,1	88	68,7	106	82,8	

The results of the study regarding the age of the respondents with the most data were in the category of the age of non-risk mothers (> 20 years and < 35 years), as many as 79 respondents

(61.7%), and the smallest data was the age of pregnant women at risk (< 20 years and > 25 years) as many as 49 respondents (38.3%). The most data is that pregnant women aged 20 weeks do not have a history of hypertension as many as 90 respondents (70.3%), and the smallest data is the age of pregnant women at 20 weeks having a history of hypertension, as many as 38 respondents (29.7%). The most data was that pregnant women were in an active/passive smoking environment with as many as 106 respondents (82.8%), and the smallest data was pregnant women in a smoke-free environment with as many as 22 respondents (17.2%).

The results of this study show that pregnant women who are exposed to cigarette smoke are more likely to experience gestational hypertension. Cigarettes are also linked to hypertension. The association between cigarettes and increased cardiovascular risk has been widely proven. Apart from the duration, the greatest risk of smoking depends on the number of cigarettes smoked per day. A person with more than one pack of cigarettes a day is 2 times more prone to hypertension than those who do not smoke. Pregnant women who are exposed to cigarette smoke have a bad effect on the condition of the fetus being conceived; cigarette smoke inhibits fetal growth and development. The respondents obtained in this study were mostly exposed to cigarette smoke, which was 82.8% more than those who were not exposed to cigarette smoke, which was 17.2%. The variable of female passive smokers has a statistical effect on the incidence of hypertension. Exposure to cigarette smoke has a strong association with an increased incidence of hypertension. The adverse effects of substances in cigarette smoke on the cardiovascular system make exposure to cigarette smoke, both active and passive, one of the significant risk factors for hypertension. Exposure to secondhand smoke has a significant impact on the risk of hypertension, both in active smokers and in people exposed to secondhand smoke (passive smokers).

DISCUSSION

This study shows that exposure to cigarette smoke, either directly or indirectly (passively), is a significant risk factor for increased blood pressure in pregnant women. Harmful components in cigarette smoke, such as nicotine and carbon monoxide, can cause vasoconstriction as well as oxidative stress, which can potentially trigger and worsen hypertension in pregnancy. Exposure to secondhand smoke not only has an impact on maternal health but also affects fetal development, which can increase the risk of pregnancy complications, including premature birth and low birth weight. These findings highlight the importance of preventive efforts to minimize exposure to cigarette smoke in pregnant women through health education and environmental monitoring, both at home and at work. It is recommended that there is a policy that supports a smoke-free environment for pregnant women to protect the health of mothers and babies. In addition, health workers need to be more active in providing the public with the dangers of exposure to secondhand smoke during pregnancy and encouraging behavioral change in families and communities to create a safe and healthy environment for pregnant women (Sominsky et al., [2023](#)). This study adds to the scientific evidence that exposure to secondhand smoke is a preventable risk factor in reducing the prevalence of hypertension in pregnancy, as well as promoting better health for mothers and children. Collaborative efforts from various parties, including governments, medical personnel, and the public, are essential to achieve this goal (Al-Saleh et al., [2024](#)).

There is a significant association between exposure to secondhand smoke and an increased risk of hypertension in pregnancy. Exposure to cigarette smoke, both from active and passive smokers, has a direct impact on the health of the mother and fetus (Grover et al., [2023](#)). This research is in line with various international studies that state that cigarette smoke has harmful chemical components, such as nicotine, carbon monoxide, and various other toxic substances that can cause an increase in blood pressure through certain physiological mechanisms (Najman et al., [2024](#)). The nicotine in cigarette smoke increases blood pressure through vasoconstriction, a narrowing of blood vessels due to stimulation of the sympathetic nervous system (Wu et al.,

2023). This vasoconstriction results in an increase in blood pressure, which is exacerbated by repeated exposure to cigarette smoke. The study also confirmed that inhaled carbon monoxide and cigarette smoke can cause tissue hypoxia (lack of oxygen), so the heart has to work harder to pump blood, ultimately increasing blood pressure. The chemicals in cigarette smoke induce oxidative stress on the walls of blood vessels, which leads to endothelial damage (the inner lining of blood vessels) (Sun et al., 2023). This damage reduces the elasticity of blood vessels and increases vascular resistance, contributing to increased blood pressure. For pregnant women, these changes can trigger gestational hypertension or worsen existing hypertension (Timsina et al., 2023).

Preeclampsia is a condition of hypertension in pregnancy that can have a severe impact on the health of the mother and fetus. Pregnant women who are exposed to secondhand smoke have a higher risk of developing preeclampsia compared to mothers who are not exposed (Moreira et al., 2024). The study explains that exposure to cigarette smoke can stimulate the release of inflammatory cytokines and increase free radical levels in the body, both of which are known to play a role in the pathogenesis of preeclampsia. Cigarette smoke can reduce placental blood flow (Meaton et al., 2023). This condition inhibits the supply of oxygen and nutrients to the fetus, which not only increases the risk of preeclampsia but can also lead to other complications, such as stunted fetal growth and premature birth (Ding et al., 2023). Exposure to secondhand smoke is often overlooked in the context of pregnant women's health.

Pregnant women who live or work in an environment with smokers have the same risk of hypertension as active smokers. Passive cigarette smoke contains about 80% of harmful substances that are also found in mainstream smoke inhaled by active smokers. The results of this study show that passive exposure to cigarette smoke should be a serious concern in public health efforts to protect pregnant women from the risk of hypertension. Exposure to cigarette smoke in pregnant women also has a direct impact on the fetus (Suprpto et al., 2024). Fetuses exposed to chemicals in cigarette smoke tend to experience intrauterine growth restriction (IUGR). This condition is caused by decreased blood flow to the placenta, which results in inadequate nutrient and oxygen intake for the fetus (AM et al., 2023). These growth disorders increase the risk of premature birth and low birth weight, both of which are important risk factors for the long-term health of babies. Babies born to mothers who smoke or who are exposed to secondhand smoke during pregnancy are at higher risk of cardiovascular complications in adulthood. This study highlights the importance of protecting pregnant women from exposure to secondhand smoke to prevent long-term health impacts on children (Sasarari et al., 2024).

The limitations that emerged in this study were the variability of the level of exposure to cigarette smoke and the influence of other factors, such as the lifestyle and diet of pregnant women, that may affect blood pressure. However, based on the available evidence, exposure to secondhand smoke is a significant risk factor that can be prevented to reduce the incidence of hypertension in pregnancy. The recommendation of this study is the need for a health education campaign about the dangers of cigarette smoke for pregnant women. Prevention programs should include raising awareness among families and the community and enforcing smoke-free environmental regulations in public places and workplaces. Medical personnel also need to educate pregnant women about the risks of exposure to cigarette smoke and the importance of creating a smoke-free environment at home.

CONCLUSIONS

This study concluded that exposure to cigarette smoke, both from active and passive smokers, has a significant impact as a risk factor for hypertension in pregnant women. Cigarette smoke contains harmful substances such as nicotine and carbon monoxide that can cause an increase in blood pressure through vasoconstriction mechanisms and oxidative stress. This condition has the potential to harm the health of the mother and fetus, increasing the risk of complications such as preeclampsia, premature birth, and low birth weight. These findings

underscore the need for preventive measures to reduce exposure to cigarette smoke for pregnant women, including health education, smoke-free environmental policies, and strengthening public awareness. The implementation of this effort is expected to reduce the prevalence of hypertension in pregnancy and support optimal health for mothers and babies.

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