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ORIGINAL ARTICLE Open Access

The Effect of Passive Smoking during Pregnancy on Low Birth Weight

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ABSTRACT

Introduction: A newborn who weighs less than 2,500 grams at delivery is considered low birth weight (LBW). There are many factors that can influence the determinants of LBW. One of the multifactorial is pre-natal exposure to tobacco smoke from the partner or environment in pregnant women (passive smokers) which provides negative effects for both the mother and the fetus. This study aims to determine the relationship between passive smoking during pregnancy and LBW at RSUD H. PadjonganDg. Ngalle Takalar in 2019.
Methods: The research is an observational analysis with a case-control approach. The population in this study is all mothers who gave birth to babies in the delivery room at RSUD H. PadjonganDg. Ngalle Takalar had 139 mothers who gave birth from January to December 2019. The sampling technique in this study used the purposive sampling
Results: The results showed the pregnant woman's environment who was most often exposed to cigarette smoke with LBW (<0.05), Cigarette smoke exposure in the home with LBW (<0.05), Cigarette smoke exposure in the outdoor environment with LBW (<0.05), Pregnant women who were exposed to cigarette smoke in one week with LBW(<0.05), Frequency of time pregnant women were exposed to cigarette smoke in one day with LBW(<0.05).
Conclusion: There is a significant relationship between passive smoking during pregnancy and low birth weight (LBW).

Keywords: Passive smoking; pregnancy; low birth weight

Article history:
Received: 1 October 2023
Accepted: 10 December 2023
Published: 21 December 2023

GREEN MEDICAL JOURNAL
E-ISSN 2686-6668

Published by:
Faculty of Medicine
Universitas Muslim Indonesia

Address:
Jl. Urip Sumoharjo Km. 5, Makassar
South Sulawesi, Indonesia

Mobile number:
+62821 9721 0007

Email:
greenmedicaljournal@umi.ac.id

Introduction

A newborn who have weight less than 2,500 grams at delivery is considered low birth weight (LBW). Between 60% and 80% of all newborn deaths are attributable to LBW, which is an indirect cause. 20 million LBW kids are born annually, or 15.5% of all LBW babies worldwide. 96,5 % of them are in underdeveloped nations.[1]

According to the 2016 district/city profile, South Sulawesi province showed a total of 148.7140 live births, 123.702 live births weighed, with 5,299 LBW cases (4.28%). The highest was in Makassar City with 690 cases, Gowa Regency (342 cases), Luwu Regency (288 cases), and the lowest cases were in Barru Regency (27 cases), Bantaeng Regency (47 cases), and Tana Toraja Regency (65 cases). The pattern of causes of infant deaths (neonatal and post-neonatal) in Takalar Regency from 2010 to 2015 was most caused by LBW, namely 33 cases.[2,3]

There are many factors that can influence LBW, including demographic factors such as maternal age, abortion history, lifestyle, health care, environment, work, noise, violence, and maternal trauma. In addition, there are nutritional factors, including protein intake, iron, and some micronutrients, and infectious factors, including urinary tract infections and other infectious diseases during pregnancy. One of the important factors among these multi-factors is prenatal exposure to cigarette smoke from the partner or environment in pregnant women (passive smokers) which has negative effects for both the mother and her fetus.[4] Pregnancy-related smoking raises the risk of low birth weight by 20–30%. It also states that low birth weight is associated with an increased risk of infant mortality, respiratory problems, and other health problems.[5] WHO states that maternal smoking is the main preventable cause of low birth weight, and accounts for approximately 20% of cases of low birth weight worldwide.[6]

Exposure to cigarette smoke to vulnerable groups such as pregnant women and babies is a problem that is quite difficult to avoid in developing countries like Indonesia. It does not only affect the health of smokers but also affects people who inhale the smoke (passive smokers), such as pregnancy complications, LBW, and even infant death. When pregnant women smoke or are passive smokers who breathe in their spouses' tobacco smoke, the chemicals in cigarettes will enter the fetus through the placenta.[7]

Carbon monoxide is a gas produced by incomplete combustion of carbon-containing fuels, such as cigarettes. When *CO* is inhaled, it displaces oxygen in the blood, forming carboxyhemoglobin (*HbCO*). *HbCO* is unable to transport oxygen to the body's tissues, including the developing fetus.[8] Low birth weight and fetal development restriction can result from *CO* exposure through a number of processes, which have been identified:

Reduced oxygen delivery to the fetus: *CO* binds to hemoglobin with a much higher affinity than oxygen, preventing oxygen from binding and being transported to the fetus. This reduction in oxygen supply can impair fetal growth and development.

Placental dysfunction: *CO* can damage the placenta, the organ that exchanges nutrients and oxygen between the mother and fetus. This damage can reduce the efficiency of nutrient and oxygen transfer, further contributing to fetal growth restriction.

Increased carboxyhemoglobin levels in the fetus: *CO* readily crosses the placenta and can accumulate in the fetal bloodstream, leading to elevated levels of *HbC*O. This further reduces the fetus's ability to transport oxygen and can lead to fetal hypoxia (oxygen deficiency).

Direct toxic effects on fetal tissues: The brain, heart, and lungs of a fetus can all be directly harmed by *CO*. These toxic effects can contribute to fetal growth restriction and developmental abnormalities.

Research has consistently shown that low birth weight and maternal *CO* exposure are strongly correlated. For example, a meta-analysis of 15 studies revealed a 12% increased risk of low birth weight (LBW) in pregnant women who were exposed to *CO*[9]. Another study found that the risk of LBW increased significantly with increasing levels of maternal *CO* exposure.[10]

This study at RSUD H. Padjonga Dg. Ngalle aims to ascertain the association between the status of passive smoking during pregnancy and Low Birth Weight.

Methods

Observational analytics using a case control methodology is the study methodology used. From January to March of 2021, this study was carried out at RSUD H. Padjonga Dg. Ngalle Takalar. All moms who gave birth in a delivery room between January and December 2019 (a total of 139 mothers) made up the study's population. Purposive sampling was the method employed for sampling in this investigation, and 60 samples were collected.

The first source of data used to collect the data was the medical records of women who gave birth to LBW children in RSUD H. Padjonga Dg. Ngalle Takalar in 2019. After that, using a questionnaire, interviews were done to determine the characteristics that were related to passive smoking during pregnancy and low birth weight in newborns. The Statistical for Social Science (SPSS) program was utilized for the data analysis in this study. Univariate analysis was employed to ascertain the characteristics of the respondents and sample. Subsequently, a bivariate analysis using the Chi-Square test was performed to ascertain whether LBW and passive smoking during pregnancy are related.

Result

Based on the results of the research and data processing that have been carried out, the following research results are presented:

Table 1. Frequency distribution of sample characteristics/research respondents:

Characteristics		n	%
Age	< 20 years	7	11.7
	20-35 years	36	60.0
	> 35 years	17	28.3
Work	Work	50	83.3
	Not Working	10	16.7
ANC	Regular	45	75.0
	Irregular	15	25.0
LBW	Light	52	86.7
	Medium	8	13.3
PP2	Home environment	50	83.3
	Work environment	10	16.7
PP3	Husband	50	83.3
	Other Family Members	10	16.7
PP4	Other People	8	13.3
	office	47	78.3
	Neighbors	5	8.3
PP5	>1 times	45	75.0
	1 times	15	25.0
PP6	>15 min	57	95.0
	<15 min	3	5.0
Total		60	100.0

The total respondents were 60. Based on Table 1, it is shown that 7 respondents (11.7%) were under 20 years old, 36 respondents (60%) were 20-35 years old, and 17 respondents (28.3%) were over 35 years old. Therefore, it is concluded that the highest frequency of respondents was in the 20-35 year age group. In addition, respondents who worked had the highest frequency of 50 respondents (83.3%), while the remaining 10 respondents (16.7%) did not work. The number of respondents with regular ANC was 45 respondents (75%) and 15 respondents (25%) with irregular ANC. In addition, respondents with mild LBW had the highest frequency of 52 respondents (86.7%), while the remaining 8 respondents (13.3%) had moderate LBW. The BBLR status variable of respondents with mild LBW had the highest frequency of 52 respondents (86.7%), while the remaining 8 respondents (13.3%) had moderate LBW.

The characteristics of the respondents PP2 (The environment of pregnant women who are most often exposed to cigarette smoke) were 50 respondents (83.3%) in the home environment and 10 respondents (16.7%) in the work environment. The characteristics of the respondents PP3 (The main source of exposure to cigarette smoke inside the house) were 50 respondents (83.3%) from their husbands and 10 respondents

(16.7%) from other family members. The characteristics of the respondents PP4 (The main source of exposure to cigarette smoke outside the home) were 8 respondents (13.3%) from other people, 47 respondents (78.3%) from work colleagues, and 5 respondents (8.3%) from neighbors. The characteristics of the respondents PP5 (Pregnant women who are exposed to cigarette smoke once a week) were 45 respondents (75%) in the >1 time category and 15 respondents (25%) in the 1 time category. The characteristics of the respondents PP6 (The frequency of time pregnant women are exposed to cigarette smoke in one day) were 57 respondents (95%) in the >15 minutes category and 3 respondents (5%) in the <15 minutes category.

Table 2. The relationship between the environment of pregnant women who are most often exposed to cigarette smoke and LBW

Variable			LBW		Total	P value
			Mild	Moderate		
PP2 The environment of pregnant women who are most often exposed to cigarette smoke	Home environment	n	46	4	50	0.021
		%	92.0%	8.0%	100.0%	
	Work environment	n	6	4	10	
		%	60.0%	40.0%	100.0%	
Total		n	52	8	60	
		%	86.7%	13.3%	100.0%	

*Chi-square test

The number of respondents for the variable PP2 (The environment of pregnant women who are most often exposed to cigarette smoke) is displayed in Table 2. The connection test's p-value of 0.021, which is below the 0.05 alpha threshold, was revealed. As a result, the alternative hypothesis, *H1*, is accepted and the null hypothesis, *H0*, is rejected. This indicates that the respondents' LBW and the variable PP2 have a significant correlation.

Table 3. The relationship between the main source of exposure to cigarette smoke in the home and LBW

Variable			LBW		Total	
			Mild	Moderate		
PP3 Main Source of Exposure to Cigarette Smoke in the Home and LBW	Husband	n	46	4	50	0.021
		%	92.0%	8.0%	100.0%	
	Other Family	n	6	4	10	
		%	60.0%	40.0%	100.0%	
Total		n	52	8	60	
		%	86.7%	13.3%	100.0%	

*Chi square test

The number of respondents for the variable PP3 (primary source of exposure to cigarette smoke in the home) is displayed in Table 3. The connection test's p-value of 0.021, which is below the 0.05 alpha threshold, was revealed. As a result, the alternative hypothesis, *H1*, is accepted and the null hypothesis, *H0*, is rejected. This indicates that the respondents' LBW and the variable PP3 have a significant correlation.

Table 4. The relationship between the main source of exposure to cigarette smoke in the outside environment and LBW

Variable			LBW		Total	p-Value
			Mild	Moderate		
PP4 Main Source of Exposure to Cigarette Smoke in the Outside Environment and LBW	Others	n	4	4	8	0.003
		%	50.0%	50.0%	100.0%	
	friends	n	44	3	47	
		%	93.6%	6.4%	100.0%	
	Neighbors	n	4	1	5	
		%	80.0%	20.0%	100.0%	
Total		n	52	8	60	
		%	86.7%	13.3%	100.0%	

*Chi-square test

The number of respondents for the variable PP4 (primary source of exposure to cigarette smoke in the outdoor environment) is displayed in Table 4. The connection test's p-value of 0.003, which is below the 0.05 alpha threshold, was revealed. As a result, the alternative hypothesis, *H1*, is accepted and the null hypothesis, *H0*, is rejected. This indicates that the respondents' LBW and the variable PP4 have a significant correlation.

Table 5. The relationship between the frequency of exposure to cigarette smoke in one week by pregnant women and LBW

Variable			LBW		Total	p-Value
			Mild	Moderate		
PP5 frequency of exposure to cigarette smoke in one week by pregnant women and LBW	>1 times	n	42	3	45	0.019
		%	93.3%	6.7%	100.0%	
	1 time	n	10	5	15	
		%	66.7%	33.3%	0.0%	
Total		n	52	8	60	
		%	86.7%	13.3%	100.0%	

The number of respondents for the variable PP5 (pregnant women who are exposed to cigarette smoke in one week) is displayed in Table 5. The connection test's p-value of 0.019, which is below the 0.05 alpha

threshold, was revealed. As a result, the alternative hypothesis, *H1*, is accepted and the null hypothesis, *H0*, is rejected. This indicates that the respondents' LBW and the variable PP5 have a significant correlation.

Table 6: The relationship between the frequency of time pregnant women are exposed to cigarette smoke in one day and LBW.

Variable			LBQ		Total	p-value
			Mild	Moderate		
PP6 frequency of time pregnant women are exposed to cigarette smoke in one day and LBW	<15 min	n	1	2	3	0.044
		%	33.3%	66.7%	100.0%	
	>15 min	N	51	6	57	
		%	89.5%	10.5%	100.0%	
Total		N	52	8	60	
		%	86.7%	13.3%	100.0%	

*Chi-square test

The number of respondents for the variable PP6 (frequency of time pregnant women are exposed to cigarette smoke in one day) is displayed in Table 6. The connection test's results revealed a p-value of 0.044, which is below the 0.05 alpha threshold. As a result, the alternative hypothesis, *H1*, is accepted and the null hypothesis, *H0*, is rejected. This indicates that the respondents' LBW and the variable PP6 have a significant correlation.

Discussion

Based on the data obtained from a study conducted at RSUD H. Padjonga Dg. Ngalle Takalar, it shows that most of the respondents in the case group were of a non-risk age group. Women under the age of 20 are four times more likely to give birth to a low-birth-weight (LBW) baby than women who give birth at a reproductive age. At the age of adolescence, the reproductive organs are still not mature, so the mother and fetus compete for nutrients. Pregnancy at the age of over 35 also has a higher risk of LBW birth due to the degeneration of the reproductive organs and hormonal imbalance. The inadequate function of the placenta also affects the production of progesterone and uterine irritability, causing changes in the cervix that can trigger premature birth.

Occupational factors can affect the incidence of LBW. In this study, occupation is one of the factors

that causes LBW. This is in line with the research by Zulardi (2014), where LBW occurred in 5.5% of pregnant women whose main work activities were done while standing, thus putting excessive strain on the uterus.[11] However, some studies show that working during pregnancy does not play a significant role in the birth weight of the baby. Routine prenatal check-ups (ANC) also affect the incidence of LBW. Pregnant women who do not routinely undergo ANC checks have a five-fold greater risk of giving birth to an LBW baby than pregnant women who routinely undergo ANC checks.[9]

The researcher assumed that passive smoking mothers who gave birth to LBW babies during pregnancy did not regularly check their pregnancies and their nutrition during pregnancy was not adequate. Insufficient nutrient intake during pregnancy can cause anemia in the baby which will affect the baby's weight.[12] The results of the chi-square test showed a significant relationship between the variables and the respondents' LBW. According to the study, the exposure of pregnant women to cigarette smoke at home came from their husbands, while exposure to cigarette smoke in the outside environment was from co-workers. The chemical content in passive smokers is higher than that in active smokers. Cigarette smoke can linger in a room for a long time, the toxins contained in cigarette smoke cling to clothing and furniture for several weeks. Respirable particulates become 3-12 times higher indoors.[13] So in this study, a husband who smokes indoors tends to increase the risk of pregnant women being exposed to cigarette smoke, especially in the second trimester, the time when organ refinement takes place, so if exposed to cigarette smoke can cause pregnancy complications.

The results of the study showed that pregnant women were exposed to cigarette smoke for 15-60 minutes more than once a day. It can be concluded that there is a significant relationship between the PP6 variable and the BBLR of the respondents. The results of this study are in line with (Cheng, 2015), which aims to assess the distribution of nicotine reaching tissues and its ability to increase protein and DNA at certain exposure levels from a cigarette. Nicotine labels were found on the liver, lungs, testicles, brain, and placenta. The level of tissue damage is visible 15-60 minutes after exposure and decreases thereafter.[14] The CDC states that “one in every five babies born to mothers who smoke during pregnancy has a low birth weight.” The report also states that mothers who are exposed to cigarette smoke during pregnancy are more likely to have babies with low birth weight.[15]

Conclusion

Based on the results of a study conducted at RSUD H. Padjonga Dg. Ngalle Takalar, it can be concluded that pregnant women who are passive smokers can affect the birth weight of their babies. Education should be provided to husbands, families, and the surrounding environment about the dangers of cigarette smoke, which not only affects active smokers, but also passive smokers, namely pregnant women

and their fetuses. If necessary, signs prohibiting smoking can be placed in the work environment and encouragement to carry out smoking activities in separate rooms, especially not smoking near pregnant women. Further research on the side effects of cigarette smoke on the fetus with a representative sample size and a wider population is expected to reduce the incidence of LBW and other complications in infants.

Conflicts of Interest

There is no conflict of interest

Funding sources

There is no funding sources

Acknowledgments

There is acknowledgments

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