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Meta-Analysis

Meta-Analysis: Effect of Cigarette Smoke Exposure on Pregnant Women as Passive Smokers on Low Birth Weight

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ABSTRACT

Background: Intrauterine exposure to tobacco smoke is considered an important risk factor for low birth weight (LBW) infants, low birth weight (SGA) infants, and preterm delivery. Mothers who smoke during pregnancy are known to limit intrauterine fetal growth and result in low birth weight. This study aims to analyze the effect of exposure to cigarette smoke on pregnant women as active smokers on the incidence of low birth weight.
Subjects and Method: This research is a meta-analysis study using PRISMA flowchart guidelines. The article search process was carried out between 2013-2021 using databases from PubMed, Google Scholar and Science Direct PICO, namely, population= pregnant women. Intervention= exposure to cigarette smoke. Comparison= not exposed to cigarette smoke. Outcome= low birth weight. The keywords used for the article search were "Pregnant or pregnancy" AND "smoking" AND "birth weight". The analysis was carried out using RevMan 5.3 software.
Results: There are 8 primary studies spread across 4 continents, namely the continents of Australia, South America, Asia, and Europe, which were selected for a systematic review and meta-analysis. The data found showed that exposure to cigarette smoke in pregnant women as passive smokers increased 2.01 times low birth weight compared to pregnant women who were not exposed to cigarettes (aOR= 2.01; 95% CI= 1.32 to 3.06; p<0.001).
Conclusion: Exposure to cigarette smoke in pregnant women as passive smokers increases the risk of low birth weight.

Keywords: Low birth weight (LBW), cigarette exposure

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BACKGROUND

Infants with low birth weight (LBW) is one of the public health problems that need attention, especially because it is the most important predictor of infant mortality in the first month of life. Babies with LBW have a 35% risk of death compared to babies born over 2,500 grams (Pantiawati, 2010).

Based on research by Rasyid et al. (2012) Exposure to cigarette smoke during pregnancy has a significant risk of 4.2 times greater for giving birth to babies with LBW. Another study showed that pregnant women who smoked heavily were 21 times more likely to give birth to LBW babies than pregnant women who smoked lightly. Pregnant women in moderate smoking

environments, on the other hand, are three times more likely to give birth to LBW babies than pregnant women in light smoking environments (Zulardi, 2014)

Cigarette smoke contains several substances such as nicotine, lead, free radicals, and carbon monoxide which can interfere with the distribution of nutrients and oxygen from the mother to the fetus, if exposed can affect the development of the fetus in the womb. This affects the development, condition, and birth weight of the baby's fetus at birth (Guan et al., 2009).

Low birth weight (LBW) is associated with increased morbidity and mortality. Waking up early also causes few complications such as respiratory illness, essential bullying or neurogenesis, compared to several months. Many factors contribute to LBW and on-time delivery, one of the most important being the following smoking attempts: B. Maternal smoking and exposure to second-hand smoke.

Mothers who smoked during pregnancy had a significantly reduced birth weight and a significantly increased risk of low birth weight babies. It was found that birth weight loss was negatively correlated with smoking rates of pregnant women. Days were significantly associated with low birth weight infants, low birth weight infants (SGA), and preterm delivery. However, smoking cigarettes per day was associated with LBW and SGA, but not with preterm infants. Women who smoked their partners were found to be 1.3 times more likely to have stunted children than women who did not smoke. If the parents smoked, they were found to be 1.3 times more likely possible to have children (Harto, 1997).

There have been several studies that have focused on the relationship between maternal smoking and childhood RWG. However, no dose-response relationship important for inferring a causal relationship has been identified. Second, several recent studies have included Asians. Japanese women generally have a lower BMI, less weight gain during pregnancy, and lower birth weight in their offspring than Western women. They also tend to emit less smoke (Raum et al, 2011).

SUBJECTS AND METHOD

1. Study Design

This research was conducted using a meta-analysis research design with the PRISMA flowchart guideline. Article searches were performed using the following databases: PubMed, Google Scholar, and Science Direct. Some of the keywords used are: “Pregnant or pregnancy” AND “smoking” AND “birth weight”.

2. Inclusion Criteria

The inclusion criteria in this research article are: full-text article using a cohort study design, research subjects are pregnant women, research outcomes are low birth weight. Multivariate analysis with adjusted odds ratio (aOR) to measure the estimated effect.

3. Exclusion Criteria

The exclusion criteria in this research articles were: articles published in languages other than English, statistical results reported in the form of bivariate analysis, articles before 2013.

4. Operational Definition of Variables

The articles included in this study were PICO-adjusted. The article search was carried out by considering the eligibility criteria determined using the following PICO model: population= pregnant women. Intervention= exposure to cigarette smoke. Comparison= not exposed to cigarette smoke. outcome= low birth weight.

Cigarette smoke contains about 7,000 harmful chemicals, such as carbon monoxide, hydrogen cyanide, and benzene. If exposed continuously, cigarette smoke can

cause damage to cells and body tissues and cause health problems for anyone who inhales it.

Low Birth Weight (LBW) is a newborn who weighs <2500g at birth without assessing gestational age.

5. Study Instruments

The study was guided by the PRISMA flow diagram and assessment of the quality of research articles using the Critical Appraisal Checklist for Cross-sectional Study (CEMBa, 2014). The 12 questions used are as follows:

1. Does the study formulate the research question (research problem) clearly?
2. Is the study design appropriate to answer the research question?
3. Is the method for selecting research subjects clearly described?
4. Does the method of obtaining the sample lead to selection bias?
5. Is the sample representative of the research target population?
6. Was the sample size estimated taking into account the results of the initial study of statistical power?
7. Was the minimum response rate achieved?
8. Is the measurement (questionnaire) valid and reliable?
9. Has statistical significance been tested?
10. Did the researcher report confidence intervals?
11. Are there any confounding factors that have not been taken into account?
12. Are the results applicable in practice/ community?

6. Data Analysis

The research articles that have been collected will be processed using the Review Manager application (RevMan 5.3). Data processing in this study calculates the value of heterogeneity. The results of data processing are presented in the form of forest plots and funnel plots.

RESULTS

The article review process using the PRISMA flowchart can be seen in Figure 1. a total of 8 articles were obtained spread over 4 continents, namely the continents of Australia, South America, Asia, and Europe.

Table 1 shows the research quality assessment of 9 articles using critical appraisal questions for cross-sectional study. The table shows 8 cohort study articles on the effect of exposure to secondhand smoke on pregnant women as passive smokers on low birth weight.

a. Forest plot

The forest plot in Figure 3 shows that there is high heterogeneity (I^2= 78%; p< 0.001), so the data analysis in the forest plot uses a random effects model. Based on the results of the forest plot, it can be concluded that exposure to cigarette smoke in pregnant women as passive smokers as much as 2.01 times increases the risk of low birth weight (LBW) compared to adolescents with normal waist circumference (aOR= 2.01; 95% CI= 1.32 to 3.06; p= <0.001).

b. Funnel plot

The funnel plot in Figure 4 shows that there is no publication bias. This is indicated by the symmetrical right and left plots where there are 6 plots on the right and 2 plots on the left. The plot on the left of the graph has a standard error between 0 and 0.6 and the plot on the right has a standard error between 0 and 0.2.

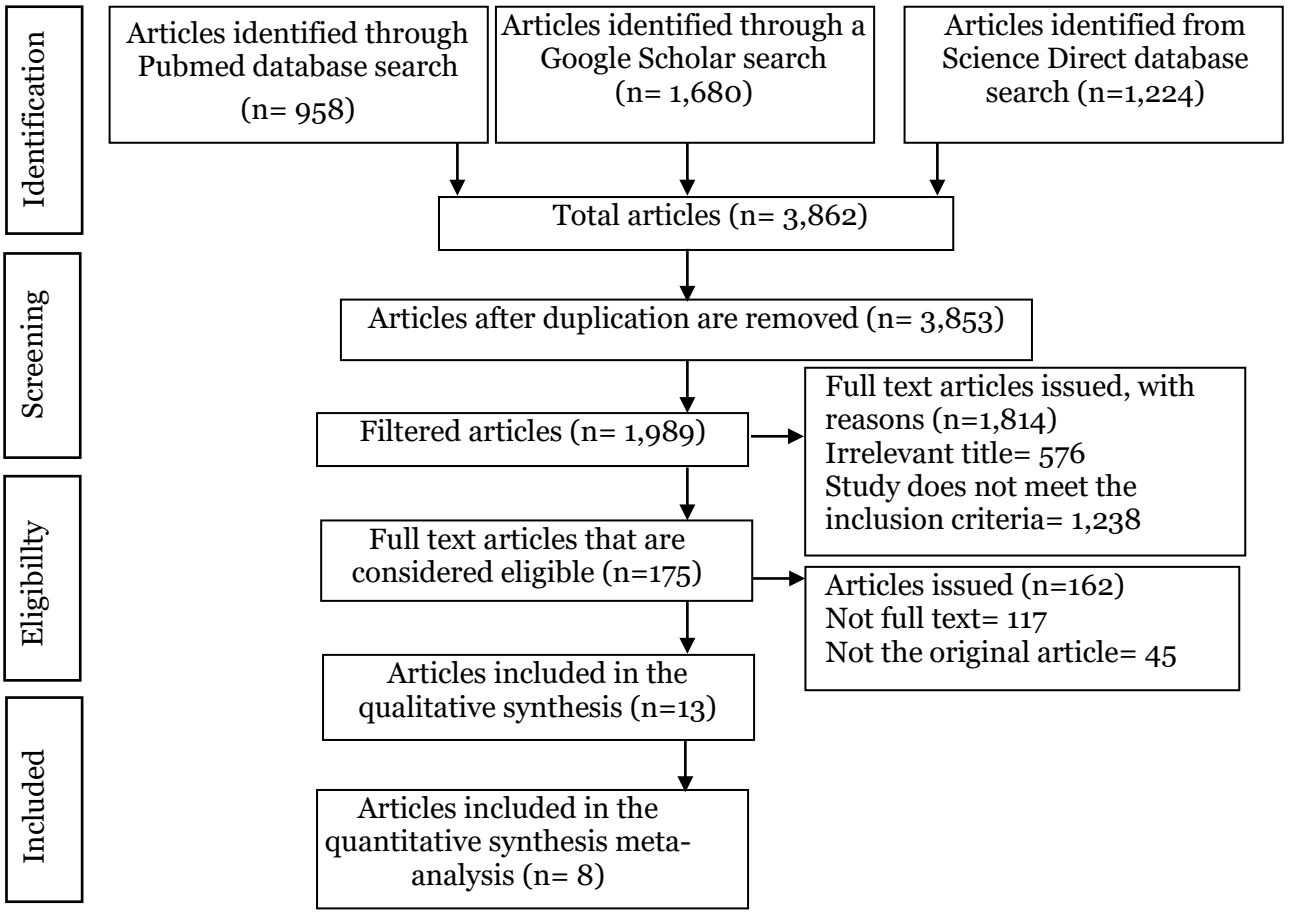

Figure 1. PRISMA flow diagram

Figure 2. Map of the research area

Table 1. Description of the smoking exposure studies included in the meta-analysis

Author	Country	Study Design	Sample	Population	Intervention	Comparison	Outcome	aOR (CI 95%)
Huang et al. (2017)	Taiwan	Cohort Study	278	Pregnant women uk<24mg	Exposure to cigarette smoke	Not exposed to cigarette smoke	LBW	3.39 (1.61 to 9.59)
Lewandoskaet al. (2020)	Polandia	Cohort Study	1,300	Pregnant women from conception - giving birth	Exposure to cigarette smoke	Not exposed to cigarette smoke	LBW	2.76 (1.05 to 7.26)
Ghimire. et al (2021)	Australia	Cohort Study	2,099	UK pregnant women 20-40 weeks	Exposure to cigarette smoke	Not exposed to cigarette smoke	LBW	0.56 (0.34 to 0.94)
Kharvova et al. (2017)	Norwegia	Cohort Study	52,806	UK pregnant women >37 weeks	Exposure to cigarette smoke	Not exposed to cigarette smoke	LBW	2.48 (1.76 to 3.49)
Meghea et al. (2014)	Rumania	Cohort Study	474	UK pregnant women >37 weeks	Exposure to cigarette smoke	Not exposed to cigarette smoke	LBW	2.80 (1.17 to 6.67)
Janevic et al. (2019)	Inggris	Cohort Study	410	UK pregnant women >40 weeks	Exposure to cigarette smoke	Not exposed to cigarette smoke	LBW	1.57 (1.24 to 2.00)
Materno et al. (2013)	Brazil	Cohort Study	565	UK pregnant women 20-28 weeks	Exposure to cigarette smoke	Not exposed to cigarette smoke	LBW	2.50 (1.32 to 4.80)
Nematollahi et al. (2018)	Iran	Cohort Study	714	UK Pregnant Women 20-38 week	Exposure to cigarette smoke	Not exposed to cigarette smoke	LBW	2.90 (1.18 to 3.71)

Table 2. Results of Quality Assessment of the Cohort Study The effect of exposure to cigarette smoke in pregnant women as passive smokers on low birth weight

No	Indicators	Publication (Author and year)							
		Janevic et al. (2019)	Huang et al. (2017)	Lewandoska et al. (2020)	Ghimire et al (2021)	Kharvova et al. (2017)	Meghea et al. (2014)	Materno et al. (2013)	Nematollahi et al. (2018)
1	Does the study address clearly focused questions/problems?	2	2	2	2	2	2	2	2
2	Is the research method (research design) appropriate the answer the research questions?	2	2	2	2	2	2	2	2
3	Is the subject selection method (employee, team, disision, organization) explained?	2	2	2	2	2	2	2	2
4	Can the way the sampel is obtained give risa to (selection) bias?	2	2	2	2	2	2	2	2
5	The sampel of subjects representative of the population to which the findings will be referred?	2	2	2	2	2	2	2	2
6	Was the sampel size based on pre-study considerations of statistical power (AOR)?	2	2	2	2	2	2	2	2
7	Was a satisfactory response rate achieved?	2	2	2	1	1	2	2	2
8	Is the measurement (questionnaire) possible valid and reliable?	2	2	2	2	2	2	2	2
9	Was statistical significance assessed?	2	2	2	2	2	2	2	2
10	Was a confidence interval given for the main outcome?	2	2	2	2	2	2	2	2
11	Could there be counfounding factor that hasn't been taken onto account?	2	2	2	2	2	2	2	2
12	Can the result be applied to your organization?	2	2	2	2	2	2	2	2
	Total	**24**	**24**	**24**	**23**	**23**	**24**	**24**	**24**

Note: 2: yes; 1: can't tell; 0: No

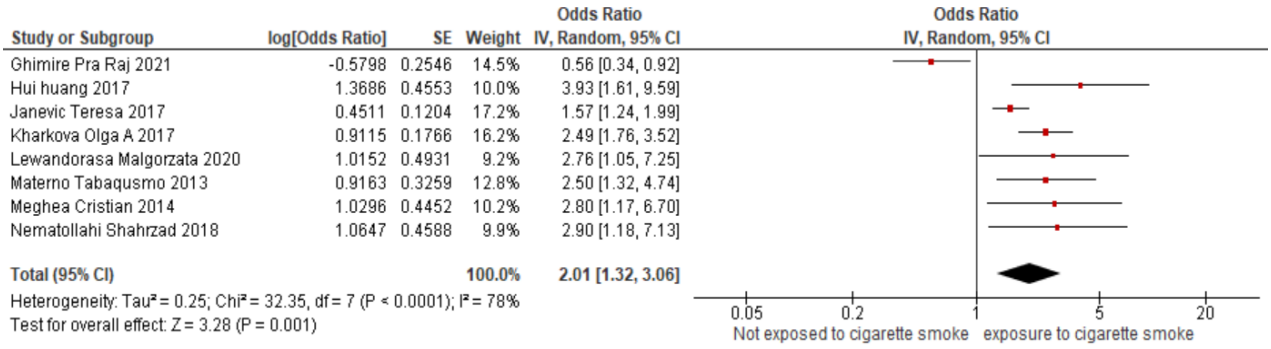

Figure 3. Forest plot effect of exposure to cigarette smoke on pregnant women as passive smokers on low birth weight

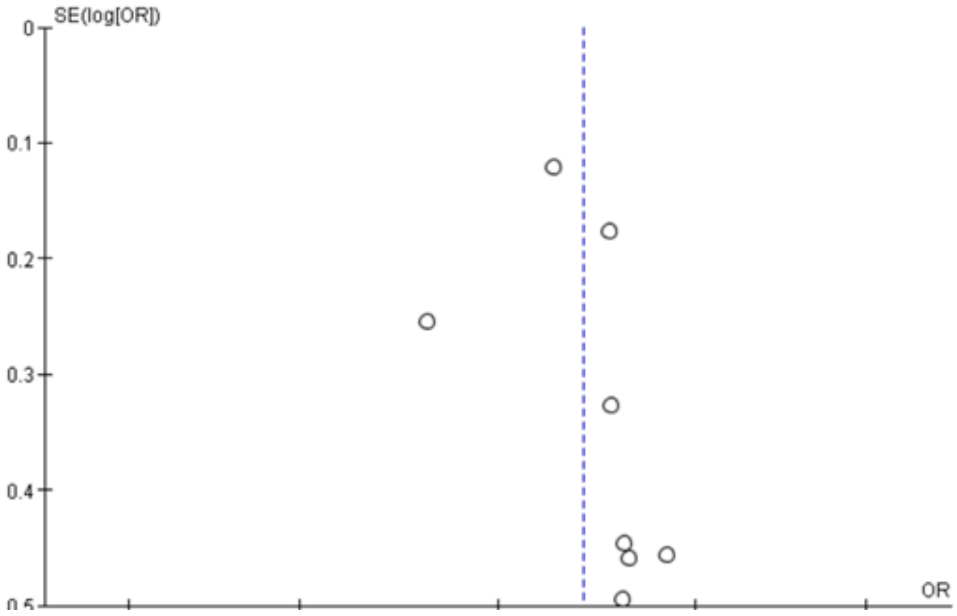

Figure 4. Funnel plot effect of exposure to cigarette smoke on pregnant women as passive smokers on low birth weight

DISCUSSION

This systematic study and meta-analysis research examines the effect of exposure to cigarette smoke in pregnant women as passive smokers on low birth weight. This study discusses exposure to cigarette smoke which is considered important because it is one of the risk factors that can lead to the birth of babies with low birth weight.

Cigarette smoke contains various compounds that are harmful to the health of the mother and fetus, including carbon monoxide (CO) and nicotine. Carbon monoxide has a higher affinity for increasing Hb compared to oxygen. Nicotine activation causes vasoconstriction in blood vessels due to the release of catecholamines by adrenal and nerve cells. Both of these will lead to reduced oxygen supply to the fetus so that the possibility of fetal hypoxia. Pregnant women who are exposed to cigarette smoke have a higher risk of giving birth to low birth weight babies seen from the cotinine levels in the baby's hair (Wickstrom, 2007).

The results of this study are based on research conducted by Rasyid et al. (2012), exposure to cigarette smoke during preg-

nancy has a significant effect of 4.2 times the risk of giving birth to LBW babies. In another study, it was shown that pregnant women with heavy smokers were at risk of giving birth to LBW babies by 21 times compared to pregnant women with light smokers. Meanwhile, pregnant women with moderate smoking environments are at risk of giving birth to LBW babies by 3 times compared to pregnant women with light smoking environments (Zulardi, 2014). A study by Lestari et al. (2015) using a case-control design in Gianyar Regency proved that exposure to cigarette smoke from husbands and exposure to cigarette smoke from family members increased the risk of LBW events with OR= 7.48 (95% CI= 2.06 to 27.18) and 9.002 (95%CI= 2.43 to 33.29). The results of another study from the BMA Tobacco Control Resource Center reported that cigarette smoke during pregnancy has a risk of giving birth to LBW about 1.5-9.9 times compared to pregnant women who are not exposed to cigarette smoke.

Based on the results of the study, it was found that there was a significant effect of smoking exposure on pregnant women on the incidence of low birth weight. Pregnant women who are exposed to cigarette smoke have a risk of low birth weight 2.01 times more than pregnant women who are not exposed to cigarette smoke. Limitations: Researchers cannot do research directly, but researchers can collect from previous researchers so that the results are subjective.

AUTHOR CONTRIBUTION

Zonna Aditya Kusumaningtiyas and Yusuf Riyadi were the main researchers who selected the topic, searched for and collected research data.

FUNDING AND SPONSORSHIP

This study is self-funded.

CONFLICT OF INTEREST

There is no conflict of interest in this study.

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