The Risk of Women Smokers against Birth Weight in Urban Rural Indonesia

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Abstract. Tobacco use such as smoking remains a major cause of death, reduced baby birth weight, and birth length, if consumed before, during pregnancy. This study aimed to analyze the risk of smoking women, and the characteristics of the baby's birth weight in urban and rural areas of Indonesia. This study is a cross-sectional survey using a two-stage stratified sampling. The sample size is 2,867 women aged 15-49 years. Significant relationships were found in the categories of maternal age (p <0.05), mother education (<0.01) and wealth status (<0.01). Logistic regression on maternal age <20 years (AOR 1.804, 95% CI 1.170-2.779), maternal age > 35 years (AOR 1.354, 95% CI 0.973-1.884). Mother education, formal (AOR 2.422, CI95% 1.230-4.768), primary (AOR 4.041, CI95% 1.894-8.623), secondary (AOR 2.262, CI95% 1.149-4.453). Wealth middle status (AOR 2.085, CI95% 1.273-3.415). Female smokers were not significantly related, but a 3% higher difference was found in the prevalence of low birth weight in mothers who smoked compared to non-smokers. Maternal age, education level, wealth status were significantly risk factors for mothers to give birth to low birth weight babies. Low birth weight is nearly as common in Indonesia’s cities as it is in the country’s rural parts.

1 Introduction

The percentage of women who smoke varies widely among countries, from 15% in the industrialized world to 8% in the poor world [1]. In Indonesia, there are 24.3% of smokers in the population aged ≥10 years who smoke every day with an average number of cigarettes per day of around 12.8 ± 8.14. As much as 80.6% smoking is done inside the building/room. Types of cigarettes smoked by people aged ≥10 years include kretek, white cigarettes, hand-rolled cigarettes, electric, and shisha. Types of cigarettes smoked the most, consecutively are kretek (67.8%); white cigarettes (43.4%); hand-rolled cigarettes (14.4%); electricity (2.8%); and shisha (1.6%) [2].

Tobacco use remains a major cause of death and disability [3]. Women who smoke before and during pregnancy cause babies to experience decreased birth weight, birth length, and head circumference [4]. The disparity in the use of tobacco in rural areas can be disproportionately detrimental to health. To help rural populations cope, we need a mix of legislation, as well as the right kind of education and social messages [5].

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In both sexes, increased levels of plasma cotinine were highly correlated with ongoing cigarette use. The relationship between education and smoking cessation has little effect [6]. Cotinine is a passive smoking measure in pregnant women, and high bodily fluid levels correspond with low birth weight due to the influence of cigarette smoke exposure on maternal genetic polymorphism, specifically from the cytochrome P (CYP) 450 subgroup and glutathione-S-transferase (GST) [1]. One of the harmful environmental factors is pregnant women's inhalation of cigarette smoke, which has been linked to low birth weight infants [7].

Pregnancy in smoking women causes a decrease in anthropometric measurements such as low birth weight (LBW) births, reduced birth length, head circumference, chest circumference, reduced gestational age [8]. Smoking during pregnancy poses a threat to intrauterine growth restriction and has a detrimental impact on birth outcomes because tobacco smoke toxins cause placental damage, abortion, respiratory complications, asthma, obesity. Likewise, the disadvantages experienced by women smokers are reproductive problems, infertility, pregnancy complications, and nicotine dependence [1]. Smoke gives adverse effects on the health of the mother and baby in the long term, namely LBW, abortion, premature birth, and death (at birth, perinatal, sudden infant death), morbidity, developmental disorders [7–10].

LBW is a worldwide health concern, especially in poorer countries [10,11]. Globally in 2015, there were 2.6 million stillbirths, with an estimated number of stillbirths 18.4/1000 births. India contributes to 22.6% of stillbirths in the world [12]. According to UNICEF data in 2014, the percentage of newborns born with a low birth weight was includes: Sub Saharan Africa 13%, West and Central Africa 14%, Latin America and Caribbean 9%, East Asia and Pacific 6%, South Asia 28%, least developed countries 13%, and World 15%. According to the 2025 Global Nutrition Targets, it is 30% reduction in LBW [13]. In Malaysia the overall prevalence of low birth weight babies is 6.38% [14].

Low birth weight (LBW) is defined as a birth in which the infant's weight is less than 2500 grams. Very low birth weight (VLBW) is defined as a birth weight of less than 1500 grams [15]. The definition of LBW, namely birth with a baby's weight <2500 g and causing serious health problems in developing countries, was also conveyed by Handriani et al, 2022 and the Indonesian Ministry of Health in 2019, while normal birth weight is around 2500-4000g [2]. In Indonesia, according to the 2018 Riskesdas results, the proportion of birth weight in children aged 0-59 is: LBW (< 2500 g) around 6.2%; 2500-2999 g as much as 29.4%; 3000-3999 g as much as 60.7%; and ≥ 4000 g as much as 3.7% [2]. The results of the study revealed that around 7.1% of children under the age of 5 in Indonesia were born with LBW [10].

LBW interacts with factors such as maternal smoking during pregnancy, domicile, mother's age, education level, type of work, family income, poverty status, mother's behavior [10,11]. The purpose of this research was to examine the characteristics of low birth weight babies and the prevalence of smoking among pregnant women in both urban and rural areas of Indonesia.

2 Method

The data source used is from the 2017 Demographic and Health Surveys (DHS). The type of research is a survey with the 2017 IDHS sampling design using two-stage stratified sampling. Census blocks were selected by systematic proportional sampling, while households were selected by systematic sampling. From July 24th, 2017, through September 30th, 2017, data was gathered. Papua, Maluku, Sulawesi, Kalimantan, Nusa Tenggara, Bali, Java, and Sumatra were all represented among the study's 34 provinces. The sample includes 1,970 census blocks in urban and rural areas. The sample is women in the research location.
The sample size is 2,867 people. The inclusion criteria were: women aged between 15-49 years, had babies and toddlers.

The household and female surveys, modeled after the DHS phase 7 (2015 edition) standard questionnaire. Indonesian version of a standard questionnaire model. Modifications are made to the response categories depending on the context. Questionnaire testing was carried out prior to the implementation of data collection, with the aim of ascertaining whether the questions could be understood clearly by the respondents. In addition to the questionnaire, all instruments and procedures were tested. The same perception and understanding of concepts, operational indicators, from variables collected in the field is very important, therefore training is needed for main instructors, field coordinators, and national instructors.

The research variables consist of independent and dependent variables. Included in the independent variables are female smokers, residence, maternal age, mother education, employment mother, wealth, while the dependent variable is the baby's birth weight. The variable of smoking women is categorized as smokers and non-smokers. Cigarettes (including kretek), cigars, shisha (water pipes) and chewing tobacco are just some of the forms of tobacco consumption. The residence variable is grouped into urban and rural. Maternal age grouped: <20 years, 20-35 years, >35 years. Mother's level of education: no formal, primary, secondary, higher. Type of mother's work: unemployed, employed. Wealth status: poorest, poorer, middle, richer, richest. Baby's birth weight: low (BW<2500 g), normal (BW ≥2500 g). Mothers' estimates of their newborns' sizes were combined with data on infant birth weight gathered from live births in the five years prior to the study.

The DHS data files of all respondents by the Institutional Review Board Findings (IRB) did not allow identification. In this survey, respondents signed a written consent form. The author has been granted permission to use the data through an ICF signed by the Data Archivist The Demographic and Health Surveys (DHS) Program. The Demographic and Health Survey (DHS) Program (DHS-7) has been approved by the International Institutional Review Board (ICF) ICF Project Number: 132989.0.000. ICF has complied with all the requirements of 45 CFR 46, “Protection of Human Subjects”.

Statistical analysis of research variables includes univariate, bivariate, multivariate tests, binary logistic regression as well as mapping by QGIS v.3.10.6. to see District-wise prevalence (%) of Women Smokers of Indonesia, 2017. Analysis used the Statistical Package for Social Studies (SPSS) version 21 software.

3 Results and Discussion

3.1 Women's Smoking, and Characteristics Relationship with Baby's Birth Weight

Women who smoke during pregnancy or who are exposed to secondhand smoke have an increased risk of having a miscarriage, a premature delivery, or a baby delivered with a low birth weight. Table 1 displays maternal features including: residence, maternal age, mother education, employment mother, wealth, and smokers cigarettes which will be associated with the baby's birth weight.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Baby's Birth Weight</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residence</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low (n =339)</td>
<td>Normal (n=2,528)</td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>115 (11.9%)</td>
<td>854 (88.1%)</td>
</tr>
</tbody>
</table>

Table 1. Descriptive statistic characteristics (n=2,867)
Table 1 shows the prevalence of birth weight according to the demographic characteristics of the mother and smoking habits. From the bivariate table it can be seen that the prevalence of low birth weight is not related to urban and rural areas, with a prevalence of around 12% in both areas. This prevalence according to the category of the mother's occupation, and smoking habits also did not show a significant difference, even though a rather high prevalence of low birth weight was seen in pregnant women who smoked compared to non-smokers, which was almost 15%. Meanwhile, a significant relationship was seen in the categories of mother's age, education and socio-economic. The interesting thing is, mothers with higher education have the highest prevalence of giving birth to children with low weight, namely 25.5%. And at the lowest socio-economic level and the richest also have almost the same prevalence for the prevalence of low baby weight, around 15%. According to the data in the table above, there is also no correlation between smoking during pregnancy and a baby being born with a low birth weight; however, the rate of low birth weight is 3% greater among moms who smoke compared to non-smokers 14.2%: 11.7% respectively.

Results residence data, were found to be different from other studies, namely that in rural areas pregnant women were found to be more likely to give birth to babies with lower weights compared to women in urban areas [14]. The results of our study: education level, mother's age, and socio-economic have similarities with other studies, namely the education level of mothers in the low category tends to give birth to babies in worse health conditions because mother's education has an adverse effect on perinatal care, including premature birth, and lower gestational age still young [16]. However, on the contrary, other studies have found different, there is no statistical relationship between maternal age and low birth weight [9].
Socioeconomic inequalities in maternal physical activity and nutritional status may be significant contributors to Malaysia's high rate of low birth weight babies [14].

Tobacco use is a problem in countries around the world, especially in low- and middle-income countries, because it poses a risk of health problems such as chronic disease and causes death [17]. Among women and adolescents with weak socioeconomic levels are more inclined to smoke during pregnancy than other women [1]. Employment status, gender, education level, economic level show a relationship with smoking behavior [17].

The results of research on smoking women, in contrast to other studies, revealed that there was a correlation between the number of cigarettes smoked and LBW births [7]. In babies born from full-term pregnancies, they are also at risk of experiencing LBW if the pregnant mother smokes during her pregnancy. Abstinence from smoking during pregnancy is useful for promoting optimal fetal development. Newborns of nonsmoking mothers are statistically shown to have a higher birth weight compared to newborns of smoking mothers. The chance of having a baby with a low birth weight increases in proportion to the quantity of cigarettes smoked daily [18]. It was reported that pregnancy was more strongly associated with smoking cessation, lower use of conventional types of cigarettes compared to electrolytic cigarettes, cigars and hookahs [19].

### 3.2 Binary Logistic Regression and Women Smokers on Low Birth Weight

Stillbirth is a serious problem that can be prevented apart from smoking cessation during pregnancy, adequate antenatal care efforts need to be made [12]. Table 2 presented binary logistic regression, from female smokers to low birth weight in Indonesia.

In Table 2, we see the results of a multivariate analysis of potential causes of a low birth weight. When controlling for other factors, the probability of having a baby with a low birth weight is higher among mothers who are younger than 20 or older than 35. Babies born to mothers under the age of 20 are more likely to be born with a low birth weight than babies born to moms between the ages of 20 and 35, and the risk increases to 1.8 times for mothers over the age of 35. Meanwhile, there is a correlation between a mother's level of education and the likelihood that her child would be born prematurely or with a low birth weight. Non-formal education has a risk of almost 2.4 times, mothers with basic education have a risk of 4.0 times and secondary education is 2.2 times the occurrence of low birth weight compared to mothers who have higher education. Meanwhile, those with medium wealth status have a 2.1 times risk of having low birth weight compared to mothers with high levels of wealth. Based on prevalence, rural areas are more at risk than urban areas even though the risk is small. Likewise, the type of mother's work is more at risk for women who don't work, whereas there is no difference between women who smoke and women who don't smoke.

**Table 2.** Binary logistic regression of smoking women on low birth weight in Indonesia
Table 2 shows the risk of having a low birth weight when compared to a normal birth weight can trigger health losses such as stunting, impaired intelligence, having an obese body weight as an adult, and in bad circumstances can cause death. Other factors that contribute to the risk of having low birth weight babies include the mother's age, mother's education, and level of wealth [20]. The results of binary logistic regression analysis of age, education, and wealth are similar to the results of other studies that have a significant relationship with LBW. LBW is a combination of several factors from the mother, including maternal age which is considered a cause of LBW and premature births [11]. Women aged 30-34 years have a greater chance of giving birth to LBW compared to women aged 15-19 years [20]. The aging mother's age describes the aging of tissue function and as the emergence of the effects of diseases that affect fetal growth disorders [11]. In Table 2, we see the results of a multivariate analysis of potential causes of a low birth weight. When controlling for other factors, the probability of having a baby with a low birth weight is higher among mothers who are younger than 20 or older than 35. Babies born to mothers under the age of 20 are more likely to be born with a low birth weight than babies born to moms between the ages of 20 and 35, and the risk increases to 1.8 times for mothers over the age of 35. Meanwhile, there is a correlation between a mother's level of education and the likelihood that her child would be born prematurely or with a low birth weight.

The results of binary logistic regression: Residence, type of work, and female smokers have similarities and differences from other studies. For residence there is a similarity in that there are more smokers found in rural areas and are associated with an age factor >45 years, whereas in urban areas it is found between the ages of 25-44 years, and in adult smokers aged 15 years and over, it is found that smokers in rural areas are higher than in urban areas [17]. It was also found that older mothers pose a greater threat of having kids with low birth weight in rural settings than they do in urban ones [14]. When it comes to reducing the risk of LBW
newborns, monitoring nutritional status in the periconception phase and during pregnancy is especially important for pregnant women with older maternal age parity in rural regions [14]. In Indonesia, working mothers' educational attainment is linked to an increased likelihood of having low birth weight (LBW) infants [21].

Contrary to the findings of other research, which have shown that being exposed to cigarette smoke greatly increases the chance of having LBW by roughly 2 times compared to those who are not exposed to cigarette smoke, the results of women who smoke are contradictory. Smoking during pregnancy is associated with an increased risk of LBW, however this is not the case for women who abstain from tobacco use throughout the first trimester [4]. Reducing tobacco use can improve health and reduce health inequities [19]. Tobacco use negatively affects the health of women of reproductive age and pregnant women. Increased carbon monoxide and nicotine levels in the mother and fetus' blood are associated with an increased risk of intrauterine growth restriction (IUGR) due to nicotine's effect of decreasing blood supply to the maternal placental circulation [7].

For tackling inequalities in health, increased support for smoking cessation should be made available, especially for those with less education, to achieve tobacco-free by 2030 [6]. Motivation to stop smoking women can be done through the approach of changing warning pictures that describe various health consequences on cigarette packs which are expected to persuade tobacco consumers to stop and save themselves from the damaging health, social, environmental and economic consequences of tobacco consumption [22]. Because secondhand smoke exposure raises the risk of weight gain in LBW babies by 2.19 times compared to those who are not exposed to cigarette smoke, raising the price of tobacco products is an effective strategy for reducing the prevalence of smoking [23].

Reducing LBW includes increasing education on understanding maternal health care, increasing levels of education, socio-economic, and support for required ANC visits [10]. Increasing understanding and awareness about LBW care with pamphlets for women is needed to maintain the quality of the future of children [24] and to reduce the risk of LBW babies in rural areas, support is needed for pregnant women with poor nutritional status, to get adequate protein and energy intake by evaluating the mid upper arm circumference (MUAC) [14]. In rural communities, it is necessary to mobilize socialization of optimal nutritional status in malnourished mothers before and during pregnancy [14]. Because the consumption of balanced nutrition is needed to optimize the growth and development of the fetus, therefore it needs support from the family to minimize risks that are detrimental to health as well as support for healthy behavior [9].

3.3 Mapping: District-wise prevalence (%) of Women Smokers of Indonesia, 2017

The district-wise prevalence of female smokers in Indonesia by province in the figure 1 provides an explanation of the distribution of the percentage of female smokers in Indonesia as a country in Southeast Asia. Figure 1 represents the percentage of smokers in each province among women in Indonesia. The 2017 Demographic Health Survey (DHS) Data explains that the highest prevalence is in the province of North Sulawesi (9.2%) and followed by 2 other provinces namely Papua (8.1%) and North Maluku (4.9%), the three regions are eastern Indonesia. Beside that, there are two provinces in the western region of Indonesia which are the regions with the lowest prevalence of female smokers in Indonesia, East Java (0.1%) and Yogyakarta (0.1%), where in both regions local culture and customary norms still restrict women from smoking.
Women who smoke are more likely to have babies with LBW. The chance of having a baby with a low birth weight is greater for moms under the age of 20 and over the age of 35 compared to those in the middle age range. Low birth weight is more common in babies born to moms with lower levels of education, including those with no formal education at all. The chance of having a baby with a low birth weight is about the same for working women and stay-at-home mothers. Women in the middle class wealth have a higher risk of having a baby with a low birth weight than do moms in the upper class. Women who smoke are at increased risk of having kids with low birth weight. The likelihood that a mother will have a baby with a low birth weight increased significantly with the mother's age, degree of education, and socioeconomic class. Low birth weight is nearly as common in Indonesia's cities as it is in the country's rural parts.

References

15. World Health Organization, WHO Recommendations for Care of the Preterm or Low Birth Weight Infant (Geneva, 2022).