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DETERMINANTS OF LOW BIRTH WEIGHT IN URBAN AREA OF INDONESIA: ANALYSIS OF THE 2017 INDONESIAN DEMOGRAPHIC AND HEALTH SURVEY

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ABSTRACT

In developing countries, low birth weight (LBW) is still considered a major public health problem among infants. The national prevalence of LBW in Indonesia is quite high and ranked 6th for LBW cases among countries in Southeast Asia. This paper aimed to study the determinant of LBW especially in the urban area of Indonesia due to the wide availability of household survey data and the limited research of LBW with a large number of samples. This study used the latest data from the 2017 Indonesian Demographic and Health Survey (IDHS). A bivariate analysis using the *Chi-square* test and a multivariate analysis tested by logistic regression was done. As many as 7,321 women of childbearing age-aged 15-49 years from the urban areas were selected as the final sample. A number of 6.7% of infants were born with LBW with a mean birth weight of 3,677 grams. This study showed a significant relationship between birth interval and maternal complication and LBW (OR:0.74; OR:2.21). Women's level of education also appeared to be significantly related to LBW (OR:0.82). The conclusion of the study was that birth interval, maternal complications, and mother's education level were closely related to LBW. Therefore, collaboration between health services, health centers, government sectors, and academicians is needed to provide standard ANC services followed by routine maternal health education is expected to reduce LBW numbers in urban areas of Indonesia.

Kata kunci:
BBLR, wanita usia subur di perkotaan, karakteristik kehamilan, perilaku sehat, faktor sosial ekonomi

ABSTRAK

Berat Badan Lahir Rendah (BBLR) masih menjadi salah satu masalah kesehatan masyarakat utama pada bayi di negara-negara berkembang. Angka nasional BBLR di Indonesia masih cukup tinggi dan menempati urutan keenam tertinggi kasus BBLR di Asia Tenggara. Studi ini bertujuan untuk mengetahui determinan BBLR khususnya pada area perkotaan Indonesia mengingat ketersediaan data survei kesehatan pada tingkat rumah tangga saat ini tersedia secara luas dan terbatasnya penelitian terkait BBLR menggunakan jumlah sampel yang besar. Penelitian ini menggunakan data terbaru dari Survei Demografi dan Kesehatan Indonesia (SDKI) 2017. Analisis yang digunakan pada penelitian ini adalah bivariat melalui uji Chi-square dan multivariat melalui uji regresi logistik. Sebanyak 7,321 wanita usia subur di perkotaan berusia 15-49 tahun didapatkan sebagai hasil akhir analisis. Sebesar 6,7% bayi yang terlahir adalah BBLR dengan rerata berat adalah 3.677 gram. Hasil penelitian ini menunjukkan bahwa jarak kelahiran dan komplikasi kehamilan berhubungan dengan BBLR (OR:0.74; OR:2.21). Tingkat pendidikan juga memiliki hubungan yang signifikan dengan BBLR (OR:0.82). Kesimpulan dari penelitian ini adalah bahwa jarak kehamilan, komplikasi kehamilan, dan tingkat pendidikan Ibu berhubungan erat dengan BBLR. Oleh karena itu, kolaborasi antara dinas kesehatan, puskesmas, sektor pemerintahan, dan akademisi dibutuhkan untuk memberikan pelayanan ANC standar yang sesuai diikuti dengan pendidikan kesehatan kehamilan secara rutin diharapkan dapat menekan angka BBLR di area perkotaan Indonesia.

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INTRODUCTION

Low birth weight (LBW) is still considered to be one of the most important causes of infants morbidity and mortality in developing countries, despite the improvement of maternal and child health quality (1,2). Recent data from World Health Organization (WHO) reported that 20.5 million infants worldwide were born with LBW and more than half were born in Asia (17.3%). In the Southeast Asian region, LBW cases reached 7-21%. Indonesia was in the range of 5-<10% and ranked 6th among countries in Southeast Asia for LBW cases (2,3). According to the latest report, the national prevalence of LBW in Indonesia is quite high (6%) and it confirmed that the rate in an urban areas (7.2%) is higher than in rural areas (6.7%) (4,5).

Each year, an estimated 1.1 million infants die from LBW complications (6). Indonesia reached 60,000 of Neonatal Mortality Rate (NMR) in 2019 and has entered the top 10 countries with the highest NMR in the world (1). Beside its association with infant mortality, LBW is also tied to the inhibition of growth and cognitive development, as well as the increase risk of chronic diseases such as cardiovascular disease and diabetes later in life (7).

Low birth weight is recognized as a multifactorial health problem among infants (8,9). Despite the two major causes of LBW, which are Small Gestational Age (SGA) and Intrauterine Growth Retardation (IUGR), there are various risks from developing countries including maternal characteristics, medical risk during gestation, maternal health behaviour, and socioeconomic factors as determinants of LBW (10,11).

In the group of maternal characteristics during pregnancy, recent documented research has shown that LBW was associated to parity, birth interval, and maternal age (12,13). LBW is also strongly related to medical risk during pregnancy through maternal complications (14). Several health behaviors during pregnancy also contributed to LBW. Compliance of prenatal iron and folic acid supplements showed to be significantly related to LBW in Malawi (15). Smoking during pregnancy among women in Brazil also presented a significant association with LBW. Furthermore, socioeconomic background was related to LBW in developing countries (16).

Indonesia is one of the fastest-growing urbanization countries in the world. Indonesia's Central Bureau of Statistics stated that, by 2020, as many as 56.7% of Indonesia's population lived in urban areas and is predicted to increase by 66.6% in 2035 (17). Indonesia, especially in the urban area where urbanization is growing rapidly, rural-urban migrants must work hard and endure harsh living and working conditions. These rural-urban migrants have to adapt to a city lifestyle and compete to earn an income that meets their expectations. Some succeed but others certainly fail. It is particularly important to find out whether rural-urban migrants sacrifice their health and that of their dependents, in particular, LBW among children (18). Therefore, determinants of LBW among children specifically in the urban area need to be investigated further.

Even though LBW is a major health issue in Indonesia, studies about LBW and its determinants specifically in urban areas using a large sample are still limited. On the basis of previously documented literature and the wide availability of household survey data, this study aims to evaluate several groups of variables (e.g., maternal characteristics, women's health behavior during pregnancy, and socioeconomic factors) as determinants of LBW specifically in urban areas so as to contribute to reducing the number of LBW in Indonesia.

METHODS

Secondary data were performed in this study. Data were drawn from the latest 2017 Indonesian Demographic and Health Survey (IDHS) conducted by the Indonesian Ministry of Health, the Indonesian Central Bureau of Statistics, and the National Population and Family Planning Board. Demographic Health Survey (DHS) is a program run by the United States Agency for International Development (USAID) which provides funds and technical assistance for the implementation of population and survey in many countries. IDHS aims to monitor and evaluate health programs once every five years. In this paper, the children's records dataset (IDKR71SV) was accessed because it contains information

related to the women's pregnancy, postnatal healthcare, and nutrition data. These data were collected using a questionnaire for women of childbearing ages, aged 15-49 years (19).

The samples in the survey were taken from rural and urban areas, covering 1,970 census blocks, 49,250 households consisting of 14,193 married men (aged 15-54 years), 24,625 unmarried male adolescents (aged 15-24 years), and 59,100 women of childbearing age (aged 15-49 years). The sampling design of the 2017 IDHS used two-stage stratified sampling. The survey distinguished sample frameworks into two: household selection and sample census block selection (19).

A cross-sectional study design was used to examine the determinants of LBW in the urban areas of Indonesia. As many as 7,321 women from urban areas were obtained from the total 17,848 population of women in this survey. The study samples were women who were interviewed and had an infant born five years before the survey in 2017 and had a record of their infants' birth weight, either from a written record or a woman's report. Women who did not complete the questionnaire or answered "do not know" were excluded from this study.

The object of this study was the infants' birth weight. This variable was categorized into two dichotomy data which are "normal weight" coded as 0 and "low birth weight" coded as 1. The WHO defines LBW as less than 2,500 grams at birth (6). As for the independent variables, this study had eight risk factors of LBW with three groups of variables consisting of: *Maternal Characteristics, Urban Women's Health Behavior during Pregnancy*, and *Socioeconomic Factors*. Women's age at childbirth was grouped into <35 and ≥35 years. Parity was split into three categories: >4 children, singleton, and 2-4 children. The preceding birth interval was classified into <24 months, first child, and ≥24 months. Maternal complication was classified as "*yes*" and "*no.*" Women's compliance with consuming iron tablets during pregnancy was sorted into "*less complete, if consume <90 tablets*" and "*complete, if consume at least 90 or more tablets.*"

The frequency of active smokes cigarettes in women was classified into three groups: do not smoke, every day (smoking at least once per day), and some days (less than once per day). Women's level of education was classed as no education; incomplete primary (has not completed elementary school); complete primary (has completed elementary school); incomplete secondary (have/are in junior high school; has completed junior high school, or have/are in high school); complete secondary (has completed high school); and higher (undergraduate/ diploma). For wealth index it was ranked as extremely poor, poor, middle, rich, and extremely rich. Wealth index was obtained by scoring each household's assets based on the number and type of goods, ranging from televisions, bicycles, cars, and housing characteristics using principle component analysis conducted by the survey agency.

SPSS 20 software was used to analyze the data. This study used a bivariate analysis using the *Chi-square* test to examine the association between all variables and LBW with an α-value of=0.05. A multivariate analysis was also done to determine how much the effect of independent variables had on LBW using logistic regression. This analysis was done with 95% CI and odds ratio by connecting both dependent and independent variables at the same time.

RESULTS

Figure 1 shows the distributions of LBW infants among women aged 15-49 years. As many as 493 (6.7%) infants were born with LBW from urban women. The mean birth weight of the infants was 3,677 gram, ranging from 200 up to 9,002 gram.

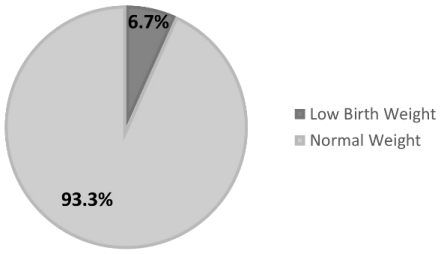

Figure 1. The Distribution of LBW Infants from Urban Women Aged 15-49 Years

Table 1 represents the characteristics of 7,321 urban women aged 15-49 years who had born infants in the last five years before the survey. In the maternal characteristics group, more than two-thirds of women in

urban areas had born their infants at the age of <35 years (77.9%), and the number of women with no complications was 80.7%. More than half of women had singleton infants (62.9%) and more than two years of birth spacing (61.5%). In the Women's Health Behavior during Pregnancy group, more than 50% of women consumed at least 90 or more iron tablets. Furthermore, this group also represents that most of the women didn't actively smoke during their pregnancy (98.2%). In the group of socioeconomic factors, urban women with no education have the lowest frequency (0.4%) while the women who completed their secondary school are the highest (38.2%). Moreover, more than one-fourth of urban women in this study was extremely rich (29.1%).

In the group of urban women's health behavior during pregnancy, women who consumed iron tablets at least 90 or more during pregnancy were also less likely to be born infants with LBW. On the other hand, urban women who smoke cigarettes every day were likely to have LBW infants (8.9%) but showed insignificant value. As for socioeconomic factors, urban women with higher education and extremely rich were less likely to have LBW infants.

The multivariate analysis result is displayed in Table 3. In this analysis, there were three significant values with $p<0.001$, consisting of preceding birth interval, complications during pregnancy, and women's level of education. Urban women with maternal complications were 2.21 times higher likely to have LBW infants [OR:2.21; 95% CI: 1.80-2.70]. These results also showed that the higher the birth spacing and educational level of urban women, the smaller chance to have infants with LBW.

Table 1. Characteristics of 7,321 Women in Urban Area of Indonesia Aged 15-49 Years

Characteristics	f	%
Maternal Characteristics		
Women's age at childbirth		
<35 years	5,704	77.9
≥35 years	1,617	22.1
Parity		
>4 children	374	5.1
Singleton	4,607	62.9
2-4 children	2,340	32.0
Preceding birth interval (months)		
<24 months	464	6.3
1st child	2,356	32.2
≥24 months	4,501	61.5
Complications during pregnancy		
No	5,907	80.7
Yes	1,414	19.3
Urban women's health behavior during pregnancy		
Compliance of consuming iron tablets		
Less complete, if consumed <90 tablets	3,530	48.2
Complete, at least consumed 90 or more tablets	3,791	51.8
Frequency smoking cigarettes		
Do not smoke	7,186	98.2
Every day	45	0.6
Some days	90	1.2
Socioeconomic factors		
Women's level of education		
No education	26	0.4
Incomplete primary	278	3.8
Complete primary	920	12.6
Incomplete secondary	1,687	23.0
Complete secondary	2,794	38.2
Higher	1,616	22.1
Wealth index		
Extremely poor	633	8.6
Poor	1,123	15.3
Middle	1,557	21.3
Rich	1,881	25.7
Extremely rich	2,127	29.1

Table 2. Bivariate Analysis between all Variables Associated with LBW

Variables	f (%)	p
Maternal Characteristics		
Women's age at childbirth		
<35 years	377 (6.6)	0.457
≥35 years	166 (7.2)	
Parity		
>4 children	23 (6.1)	0.150
Singleton	177 (7.6)	
2-4 children	293 (6.4)	
Preceding birth interval		
<24 months	35 (7.5)	0.004*
1st child	189 (8.0)	
≥24 months	269 (6.0)	
Complications during pregnancy		

Variables	f (%)	p
No	332 (5.6)	<0.001 *
Yes	161 (11.4)	
Urban women's health behavior during pregnancy		
Compliance of consuming iron tablets		
Less complete, if consumed <90 tablets	268 (7.6)	0.005*
Complete, at least consumed 90 or more tablets	225 (5.9)	
Frequency smoking cigarettes		
Do not smoke	486 (6.8)	0.368
Every day	4 (8.9)	
Some days	3 (3.3)	
Socioeconomic factors		
Women's level of education		
No education	3 (11.5)	<0.001 *
Incomplete primary	25 (9.0)	
Complete primary	88 (9.6)	
Incomplete secondary	121 (7.2)	
Complete secondary	181 (6.5)	
Higher	75 (4.6)	
Wealth index		
Extremely poor	56 (8.8)	0.012*
Poor	90 (8.0)	
Middle	101 (6.5)	
Rich	129 (6.9)	
Extremely rich	117 (5.5)	

Statistical *Chi-square* test
LBW = low birth weight
*) = significant p value
n (%) = number and percentage of BBLR-related sample within each variable
α = 0.05

Table 3. Multivariate Analysis of Variables Associated with LBW

Variables	OR	95% CI for Exp-B [Upper-Lower]	p
Maternal Characteristics			
Women's age at childbirth	1.16	[0.92-1.46]	0.198
Parity	1.06	[0.89-1.25]	0.497
Preceding birth interval	0.74	[0.63-0.87]	<0.001*
Complications during pregnancy	2.21	[1.80-2.70]	<0.001*
Urban women's health behavior during pregnancy			
Compliance of consuming iron tablets	0.87	[0.72-1.05]	0.164
Frequency smoking cigarettes	0.71	[0.43-1.16]	0.179
Socioeconomic factors			
Women's level of education	0.82	[0.74-0.89]	<0.001*
Wealth index	0.96	[0.89-1.05]	0.449

Statistical test using binary logistic regression. LBW = Low Birth Weight. OR = Odds Ratio. CI = Confident Interval. *) = significant p value

DISCUSSION

Relationship between Maternal Characteristics of Urban Women and Low Birth Weight

In the group of maternal characteristics, bivariate analysis conducted in this study indicates positive correlations between preceding birth interval and maternal complications but shows no significant results for maternal age and parity. These results were strongly supported by the multivariate analysis which shows a significant correlation for both birth interval and maternal complications. In these findings, women who gave birth to their first child were likely to have the highest number of LBW (8.0%), followed by women with less than 24-months birth interval (7.5%). In line with the previous study, a community study from 282 pregnant women with 45.2% LBW infants in the urban areas of Greater Mumbai, India showed a highly significant association between birth spacing and LBW. The highest distribution of LBW infants was from women who had <2 years of birth spacing (76.5%), followed by a birth interval of 2-4 years (42.9%) (20). Again, a recent study showed the highest percentage of LBW infants was from women who had less than 1-year birth interval (45.2%), followed by women with 1-2 years of birth interval (41.7%), while the lowest number of LBW was from mothers with two years or more birth interval (21). Evidence has consistently shown

that two years of birth interval improves the chances of infant survival.

A possible explanation for the association between birth interval and LBW, as this study shows, is that low in preceding birth interval was linked to the increase of maternal complications. The present study has revealed that complications during pregnancy were higher in women with LBW children, especially from women with short birth interval (20.3%) (22). It could happen because the pregnancy with <2 years (24 months) birth interval increases the risk of bleeding after birth. In this condition, the woman's womb is not ready to be the place for the fetus' implantation (23). While women with two years or more of birth spacing are inferred to be more optimal conditions for mothers to give birth. This condition is associated with the optimal growth and development of the fetus because the reproductive function has returned to normal (24).

Meanwhile, the insignificant result for maternal age and LBW in this study was similar to research conducted in Hospital X, Indonesia (25). A case study from 123 women in *Panembahan Senopati* Hospital showed that there was no relationship between women's age and LBW (p=0.669). Furthermore, a study based on the 2012 Indonesian Demographic and Health Survey also stated that there was an insignificant relationship between parity and LBW (p=0.137) (26). It possibly happened because maternal age and parity are not the direct cause of LBW (6).

Another study regarding the association between maternal complications and LBW was the latest study in an urban area of *Kancheepuram* District, India (27). Women with complications such as gestational diabetes mellitus (GDM), pre-eclampsia or pregnancy-induced hypertension (PIH), vaginal bleeding, and antepartum hemorrhage were significantly associated with LBW in born infants. A previous study from 565 Turkish women also showed a significant correlation between maternal complications such as pre-eclampsia and antenatal bleeding after birth with LBW (28).

Furthermore, the results from this study did not agree with some research regarding birth interval, maternal age, and parity. There was no significant correlation between birth interval and LBW conducted in *Nusa Tenggara Timur* Indonesia with 68 sample women (p=0.476) (29). It possibly happened because the number of samples were significantly different between the two studies. A meta-analysis showed different results compared to this study. There was a strong correlation between maternal age and parity with LBW. Nulliparous and women aged <18 years had the highest odds of LBW (30).

Relationship between Urban Women's Health Behavior during Pregnancy and Low Birth Weight

There were two health behaviors during pregnancy represented in this study, consisting of compliance with consuming iron tablets and frequency of smoking cigarettes. The bi-variate analysis represents a significant relationship between compliance with consuming iron tablets with LBW. In contrast, the multivariate showed insignificant association in both variables.

Morbidity and mortality of pregnant women and infants are often caused by anemia. One of the efforts to prevent anemia and maintain fetal growth in pregnant women is to take iron tablets, at least 90 tablets during pregnancy. Meanwhile, this study didn't show significant relationship between compliance of consuming iron tablets and LBW in the multivariate analysis. This result was supported by a case-control study conducted in Ethiopia which stated that after iron supplementation was entered into the multivariate analysis ended up showing insignificant result (31). This result showed that, although urban women who have incomplete iron supplementation are likely to have higher LBW infants, the other direct determinants were stated to have stronger impact on LBW. Nevertheless, other studies showed that taking complete iron supplementation was very important due to the strong relationship with LBW (15,32).

Smoking is one of the habits that should be avoided by women during pregnancy, both as active and passive smokers. Based on this study, there was no significant association between smoking habit and LBW. These result was in line with a study in the United States which showed that smoking did not have a significant effect on LBW (33). This was in contrast to research in Okinawa, Japan, which showed that smoking has a significant association on BBLR for all ages of

women (≤19 years, 20–24 years, 25–29 years, 30–34 years, 35–39 years, and ≥40 years) (p<001). This can be due to the prevalence of Japanese women who smoke was quite high at 11.2% in 2017 (34,35).

The study's data showed that the overall number of women who smoked on a daily basis as only 1.2%. This number is not much far from the data of the National Health Indicators Survey (Sirkesnas) (2016) where the national prevalence of women smoking, including smoking daily, periodically, or chewing tobacco, is 2.5% (36). This suggests that LBW among Indonesian women, especially in urban area, is more influenced by other risk factors. In Indonesia, smoking habits are tended to be done by men rather than women, so that the results of this study do not show significant numbers.

Relationship between Socioeconomic Factors of Urban Women and Low Birth Weight

Socioeconomic factors play important roles in women's health during pregnancy. This study demonstrates that the urban women's level of education and wealth index status were found to be associated with LBW through bi-variate analysis. In multivariate analysis, the education level of urban women reported a significant correlation with LBW. Documented evidence from the urban area of Bangladesh and several districts in India showed the same result. Women with low socioeconomic status and poor educational level were likely to have infants with LBW (10,27,37). Other research states that case-control study among the child-mother population in Bangladesh stated that socioeconomic status consisting of income and education highly affected infants' birth weight (37). It is possible because women with a low level of education may practice poor health behavior (e.g., drug, smoking, poor dietary habit, etc.) compared to women with a higher level of education. In addition, they may lack access to get adequate information and antenatal care access, which consequently affects neonatal growth (38–40).

This study provides strong evidence related to the determinants of low birth weight among urban women in Indonesia with large sample size. However, this study also had several limitations due to the usage of secondary data which generated variables available in the dataset.

CONCLUSIONS AND SUGGESTIONS

Conclusions

To summarize, LBW among infants born from urban women were associated with preceding birth interval, maternal complications, and women's level of education.

Suggestions

Increasing health education and awareness related to a good birth interval, maternal complication prevention, and how to maintain the health of the pregnancy are very important to be applied. Standard antenatal care-based intervention with the routine maternal health education in LBW prevention, collaborated by community health centre, health service, government sector and academic field, is expected to suppress the number of LBW in Indonesia. Moreover, adequate antenatal care (ANC) visits should be more considerate to prevent and overcome maternal complications in urban women's pregnancy.

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