RISK FACTORS OF LOW BIRTH WEIGHT (LBW) INCIDENCE. A CASE CONTROL STUDY

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ABSTRAK

*Angka kejadian BBLR di wilayah Puskesmas Panekan Kabupaten Magetan meningkat setiap tahunnya, yaitu dari 32/644 persalinan di tahun 2012 menjadi 55/770 persalinan di tahun 2013. Faktor risiko yang paling berpengaruh dalam mendukung kejadian BBLR dan alternatif solusi di wilayah ini belum diketahui karena belum ada penelitian yang dilakukan sebelumnya tentang penyebab BBLR. Tujuan penelitian ini adalah untuk mengetahui faktor risiko penyebab kejadian BBLR di wilayah Puskesmas Panekan Kabupaten Magetan. Penelitian ini berjenis observasional analitik dengan desain case control. Populasinya adalah ibu bersalin di tahun 2013-bulan Mei 2014. Pengambilan sampel dengan teknik consecutive sampling. Besar sampel 40 responden dari kelompok BBLR dan 40 responden dari kelompok berat lahir normal. Variabel independen penelitian ini adalah status gizi ibu (LILA, IMT awal kehamilan, kenaikan berat badan selama kehamilan), umur ibu, paritas, penyakit penyerta selama kehamilan, pendidikan, pekerjaan, penghasilan, dan pengetahuan gizi. Variabel dependen adalah berat badan bayi baru lahir. Instrumen penelitian menggunakan lembar kuesioner dan pengambilan data dilakukan dengan kunjungan rumah. Analisis data menggunakan uji Chi-square dan regresi logistik. Faktor risiko yang berhubungan dengan kejadian BBLR di wilayah Puskesmas Panekan adalah LILA, kenaikan berat badan selama kehamilan, umur ibu, penyakit penyerta selama kehamilan, dan pengetahuan gizi, sedangkan IMT awal kehamilan, paritas, pendidikan, pekerjaan, penghasilan tidak berpengaruh secara signifikan. Sebagai simpulan, LILA dan IMT awal kehamilan baik digunakan sebagai skrining awal untuk menentukan kenaikan berat badan ideal ibu, intervensi gizi maupun edukasi yang diberikan selama kehamilannya. Skrining faktor risiko, memantau kesehatan ibu, monitoring status gizi dengan memantau kenaikan berat badan selama kehamilan harus dilakukan melalui ANC yang adekuat untuk menekan kejadian BBLR.**(FMI 2014;50:270-277)***

Kata kunci: *BBLR, faktor risiko, kehamilan*

ABSTRACT

*The incident of LBW (Low Birth Weight) in Panekan Public Health Center (PHC), Magetan, increased from 32/644 births in 2012 to 55/770 births in 2013. The main factor of LBW was still undiscovered because there was no research conducted in this area. The purpose of this study was to discovered and determined risk factors which caused LBW. This study was an observational study using case control approach. The population is delivered mothers in 2013 to May 2014. Sampling was done through consecutive sampling methods. Data collection obtained through questionnaire of 40 respondents from LBW group and 40 respondents from normal birth weight group. The independent variables in this study were maternal nutritional status (MUAC, BMI in early pregnancy, and weight gain during pregnancy), age, parity, illness during pregnancy, education, occupation, income, and nutrition knowledge. The dependent variable was the weight of newborns. Data analysis used Chi-square test with $\alpha = 0.05$ and logistic regression. The results showed that the risk factors were MUAC, weight gain during pregnancy, age, illness during pregnancy, and nutritional knowledge, whereas BMI in early pregnancy, parity, education, occupation, and income weren't significant. In conclusion, MUAC and BMI in early pregnancy can be used for the first line screening to determine ideal weight gain, nutrition intervention or education during pregnancy. Screening of risk factors, mother's health, and monitoring nutritional status by observing weight gain during pregnancy should be done through adequate antenatal care to suppress LBW incidence.**(FMI 2014;50:270-277)***

Keywords: *low birth weight, risk factors, pregnancy*

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INTRODUCTION

Babies with low birth weight (LBW) until today remains one of the risk factors that contribute to the amount of mortality, morbidity, and disability baby. Low birth weight is a reliable index of retarded fetal growth and survival factors that determine a child's future physical growth, mental development, as well as provide long-term impact on his life in the future.

Report of Basic Health Research (*Riset Kesehatan Dasar/Riskesdas*) in 2013 showed that in Indonesia,

10.2% of infants born with low birth weight. East Java Provincial Health Office in the publication entitled Profile of Health in 2012 also reported that there were 3.32% LBW babies obtained through the percentage of 19,712 infants from 594,461 newborn infants were weighed, and Magetan ranks 11th ie 4.18%. Data delivery in the region Panekan Health Center, District Panekan, Magetan in 2012 showed that 644 deliveries, there were 32 (4.97%) infants with low birth weight, 606 (94.1%) infants with normal birth weight, and 6 (0.93%) infants born with higher birth weight. In 2013, of 770 deliveries, there were 55 (7.14%) infants with low birth weight, 706 (91.69%) infants with normal birth weight, and 9 (1.17%) birth weight infants more bodies. This indicates an increase in the number of newborns with low weight that requires special attention.

Proverawati (2010) found several factors that can affect birth weight, among others, socio-economic status, nutritional knowledge, co-morbidities during pregnancy, maternal age, and parity. Maternal nutrition is one of the risk factors of babies born with low birth weight (LBW). Pregnant women with the status of malnutrition would be at risk of having low birth weight 2.4 times compared to pregnant women with good nutrition (Manuaba 2008). This study is expected to be the basis of efforts to suppress the incidence of low birth weight is increasing in the region Panekan Health Center, District Panekan, Magetan.

MATERIALS AND METHODS

This study was an observational analytic study with case control approach. This study was conducted in 17 villages under the service of Puskesmas Panekan Magetan in April-May 2014. The respondents of this study is the whole maternity in 2013 until May 2014 who meet the inclusion and exclusion criteria. Criteria for inclusion in this study were newborn (single), and the mother agreed to become a research respondents. Exclusion criteria in this study were women who did not have complete data, twins, and the mother did not agree to be respondents in the study.

The independent variables are the socio-economic (education, employment, and income), knowledge of nutrition during pregnancy, maternal age, parity, nutritional status (MUAC, early pregnancy BMI and weight gain during pregnancy), and comorbidities during pregnancy. The dependent variable in this study was the weight newborns. Univariate descriptive and analytical analysis used to observed the distribution of frequencies and percentages of each variable. Results of the analysis in the form of a frequency distribution of each risk factor LBW. Bivariate analysis used statistical test Chi-Square to see the relationship with risk factors for LBW, and multivariate analysis with logistic regression to determine the factors that mostly influenced the incidence of low birth weight in the region of Puskesmas Panekan.

RESULTS

We obtained 80 respondents who meet the inclusion and exclusion criteria in this study. Fourty respondents in the group of low birth weight and 40 respondents in a the group of normal birth weight. The analysis showed variable early pregnancy BMI, parity, education, employment and income has a value of $p > 0.20$ so it is not included in the multivariate analysis. Results of multivariate logistic regression analysis can be seen in Table 3. Results of the logistic regression analysis explained that the four variables (weight gain, maternal age, co-morbidities during pregnancy and nutritional knowledge) have an influence on the incidence of low birth weight, with the order of the strength of the relationship based on the magnitude OR sequentially is morbidities during pregnancy, weight gain during pregnancy, knowledge of nutrition during pregnancy and maternal age.

Equations derived from the value of the coefficient of each variable is as follows: y = - 3.274 + 2.090 (weight gain during pregnancy) $\pm$ 1.161 (age mother) + 3,331 (comorbidities during pregnancy) $\pm$ 1.173 (nutritional knowledge). Application of these equations can be used to predict the probability of a mother to give birth to low birth weight. Examples of forecasting the probability is as follows: "A pregnant woman aged 36 years, mother has high blood pressure (150/100 mmHg) during pregnancy, early pregnancy normal BMI (19.5), weight gain 9 kilos (including less because of the IMT normal recommended weight gain is 11.3 to 15.9 kg), during the health center before giving birth control to nutrition knowledge score of 70". The case can be used to predict the proportion of LBW by using the following equation:

y = -3.274 + 2.090 (weight gain) + 1.161 (maternal age) + 3,331 (comorbidities during pregnancy) + 1.173 (knowledge of nutrition) = -3.274 + 2.090 (1) + 1.161 (1) + 3.331 (1) + 1,173 (0) = 3.308
then inserted into the formula:

$$p = \frac{1}{(1+e^{-y})} = \frac{1}{(1+2{,}7^{-(3{,}308)})} = 0{,}9639 = 0{,}96$$

Table 1. Distribution of the frequency of each risk factor LBW of 80 respondents in the region Puskesmas Panekan.

Respondent's Characteristic		Total (n=80)	Percentage (%)
MUAC	< 23.5 cm	42	52.5
	> 23.5 cm	38	47.5
Early Pregnancy BMI	< 18.5	17	21.2
	> 18.5	63	78.8
Weight gain during pregnancy (according to early pregnancy BMI and BMI table)	Less	58	72.5
	Normal	22	27.5
Mother's age	< 20 or > 35 years	22	27.5
	20-35 years	58	72.5
Parity	Primipara	36	45
	Multipara	44	55
Comorbidities during pregnancy	Healthy	56	70
	Comorbidity	24	30
Mother's education	Uneducated, elementary, junior high school	42	52.5
	Senior high school, diploma, college	38	47.5
Mother's Occupation	Employed	17	21.2
	Unemployed	63	78.8
Family's salary	< Mininum Wage	36	45
	≥ Mininum Wage	44	55
Nutritional Knowledge	Less	41	51.2
	Good	39	48.8

Table 2. Results of statistical test Chi-square risk factors for LBW

Nutritional Status	Category	LBW				Total		P value	OR (95% CI)	KK
		Yes	%	No	%	n	%			
MUAC	Risk (< 23.5 cm)	26	65	12	30	38	47.5	0.004	4.333 (1.696-11.069)	0.350
	No risk (≥ 23.5 cm)	14	35	28	70	42	52.5			
	Total	40	100	40	100	80	100			
Early pregnancy BMI	Risk (< 18.5 cm)	8	20	9	22.5	17	21.2	1.000	0.861 (0.295-2.518)	
	No risk (≥ 18.5 cm)	32	80	31	77.5	63	78.8			
	Total	40	100	40	100	80	100			
Weight gain during pregnancy (according to early pregnancy BMI and BMI table)	Risk (Less)	37	92.5	21	52.5	58	72.5	0.000	11.159 (2.951-42.200)	0.448
	No risk (Normal/More)	3	7.5	19	47.5	22	27.5			
	Total	40	100	40	100	80	100			
Mother's age	Risk (< 20 or > 35 years)	16	40	6	15	22	27.5	0.024	3.778 (1.291-11.057)	0.280
	No risk (20-35 years)	24	60	34	85	58	72.5			
	Total	40	100	40	100	80	100			
Parity	Multipara	23	57.5	21	52.5	44	55	0.822	1.224 (0.507-2.957)	
	Primipara	17	42.5	19	47.5	36	45			
	Total	40	100	40	100	80	100			
Comorbidities during pregnancy	Risk (with disease or complications)	22	55	2	5	24	30	0.000	23.222 (4.917-109.670)	0.546
	No risk (healthy)	18	45	38	95	56	70			
	total	40	100	40	100	80	100			
Mother's education	Uneducated, elementary, junior high	18	45	24	60	42	52.5	0.263	0.545 (0.224-1.325)	
	Senior high, diploma, undergraduate	22	55	16	40	38	47.5			
	total	40	100	40	100	80	100			
Occupation	Employed	10	25	7	17.5	17	21.2	0.585	1.571 (0.531-4.651)	
	Unemployed	30	75	33	82.5	63	78.8			
	total	40	100	40	100	80	100			

Salary	< Minimum wage (Rp. 1 million)	18	45	18	45	36	45	1.000	1.000 (0.414-2.413)	
	≥ Minimum wage (Rp. 1 million)	22	55	22	55	44	55			
	Total	40	100	40	100	80	100			
Nutritional knowledge	Less	27	67.5	14	35	41	51.2	0.007	3.857 (1.526-9.750)	0.325
	Good	13	32.5	26	65	39	48.8			
	Total	40	100	40	100	80	100			

Table 3. Results of multivariate logistic regression analysis (backward conditional method)

	Variable	Coefisien	P	OR (CI 95%)
Step 1	MUAC	0.797	0.231	2.218 (0.602-8.180)
	Weight gain	1.812	0.046	6.121 (1.029-36.389)
	Maternal age	1.206	0.098	3.339 (0.801-13.917)
	Comorbidities during pregnancy	3.412	0.001	30.322 (4.432-207.438)
	Nutritional knowledge	1.041	0.117	2.831 (0.770-10.402)
	Constant	-3.368	0.000	0.034
Step 2	Weight gain	2.090	0.018	8.087 (1.429-45.762)
	Maternal age	1.161	0.101	3.193 (0.796-12.808)
	Comorbidities during pregnancy	3.331	0.001	27.964 (4.256-183.741)
	Nutritional knowledge	1.173	0.071	3.233 (0.904-11.558)
	Constant	-3.274	0.000	0.038

The proportion of women had to give birth to 0.96 babies LBW. Note: The factor with risk is 1, and the factor without risk was 0. The value of the quality of these equations can be reviewed in terms of both calibration and discrimination. Value was based on the calibration parameters that can be seen from the results of Hosmer and Lemeshow test was 5.827 with a significant value of 0.560 or p > 0.05 showed good calibration.

The quality equation based methods Receiver Operating Curve (ROC) assessed by looking at the Area Under the Curve (AUC). AUC values were increasingly approaching the value with discrimination. AUC variable maternal weight gain during pregnancy and comorbidities were in the range 0.70 to 0.80 in a scale that is good enough or being. AUC variables maternal age and maternal nutritional knowledge are in the range from 0.60 to 0.70 in a scale which was regarded as weak.

DISCUSSION

Research conducted by Tang et al (2013) published in the journal Food and Nutrition Technical Assistance (FANTA) III explained that there was a relationship between MUAC with LBW. Mothers who have a MUAC < 23.5 cm had 1.7 times the risk of having a baby of low birth weight, 1.1 times more at risk of giving birth preterm infants, and 1.5 times at risk of SGA compared with mothers with MUAC ≥ 23.5 cm. The study of anthropometric indicators for predicting the risk of LBW babies in India by Dhar & Badhra (2008) explains that MUAC may be used for screening purposes, but not for the purpose of monitoring for changes LILA during pregnancy, which is often overlooked. Pre-pregnancy weight is the best indicator for identifying risk in women, because we can not only identify, but also have enough time to provide appropriate interventions (dietary supplements, nutritional education, etc) to increase the weight appropriate level to be achieved.

Table 4. Results of forecasting equation proportion of LBW

	Weight Gain	Mother's Age	Comorbidities During Pregnancy	Nutritional Knowledge	Proportion of LBW
P1	1	1	1	1	0.9885
P2	1	1	1	0	0.9639
P3	1	1	0	0	0.4943
P4	1	0	0	0	0.2358
P5	0	0	0	1	0.1104
P6	0	0	1	1	0.7724
P7	0	1	1	1	0.9149
P8	0	0	0	0	0.0373

Discrimination parameter equation quality can be seen in Figure 4 and Table 5.

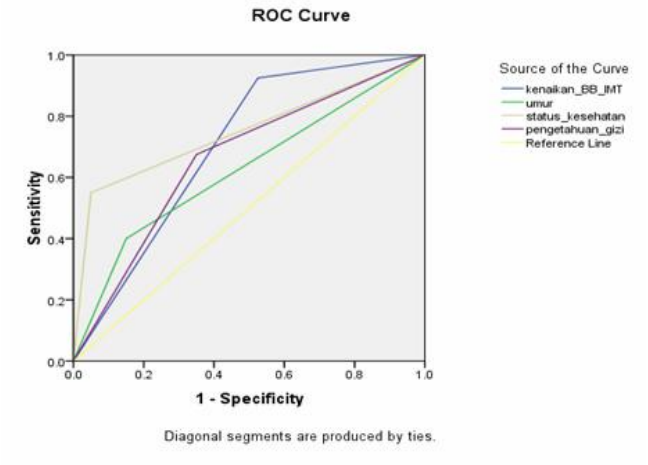

Figure 1. Diagram curve logistic regression analysis based on the method ROC

Table 5. Area Under the Curve (AUC)

Test Results Variable(s)	Area
Weight gain	0.700
Mother's age	0.625
Comorbidities during pregnancy	0.750
Nutritional knowledge	0.662

Table 6. Coordinates of the Curve

Variable	Sensitivity	I-Specitivity
Weight gain during pregnancy	0.925	0.525
Mother's age	0.400	0.150
Comorbidities during pregnancy	0.550	0.050
Nutritional knowledge	0.675	0.350

Statistical analysis showed that there is a relationship between MUAC with LBW (p = 0.004), and weight gain with low birth weight (p = 0.000), but there was no relationship between BMI early pregnancy with low birth weight (p = 1.000). Results of a study of 80 mothers in the area of the PHC Panekan maternity Magetan throughout the year 2013 to the month of May 2014 concluded that most of the mothers had a good size LILA (≥ 23.5 cm) that is by 52.5% and which has a size of less LILA (< 23.5 cm) of 47.5%. The number of mothers who do not know that MUAC is also one indicator of nutritional status in pregnant women are also high. Mothers with less MUAC will be at risk of having low birth weight have a 4.3 times compared to the normal LILA.

Maternal weight gain are grouped into two groups, namely less and normal. The determination of this group is determined by looking at the BMI of mothers in early pregnancy, then matching the tables BMI and weight gain is recommended. The number of mothers who had normal LILA size is not small, and most of the mothers had a normal early pregnancy BMI, but the number of women with less weight gain when adjusted for BMI table is as high as 58 people (72.5%) and 37 of the number of gave birth to a baby of low birth weight. IMT in early pregnancy show different things. Mothers with a good baseline BMI more precisely having a baby of low birth weight (80%) than women with baseline BMI risk who gave birth to LBW babies (20%). It is having researched again find an explanation that most of the mothers have a good BMI at the beginning of her pregnancy. However, during her pregnancy, maternal weight gain does not comply with the minimum weight gain to be achieved when compared with baseline BMI pregnancy. A case in point is the following: mother "A" has a good early pregnancy with BMI 19.5. LILA 24 cm. Weight gain during pregnancy 9 kg. Risk factors besides weight gain was 0 (no risk). Baby's weight 2300 grams at birth, gestational age at delivery 38-39 weeks. Weight gain recommended for mothers "A" according to the table BMI before pregnancy and weight loss recommendations is 11.3 to 15.9 kg. Maternal weight gain less that can increase the risk of low birth weight infants born despite sufficient gestation (term) and LILA is currently screening at the beginning of good antenatal visits.

Another case of the mother "B" she has a baseline BMI of 17.9 pregnancies. Weight gain during pregnancy ranges between 11-12 kg. LILA 22.5 cm. Early pregnancy risk factors in addition to BMI and MUAC was 0 (no risk). Baby's weight 2300 grams at birth, gestational age at birth of 40 weeks. The weight gain when adjusted for weight gain recommendations in general (10 to 12.5 kg) had reached the target, but when adjusted for BMI table, the increase is less due to maternal underweight (BMI < 18.5) weight gain Advice

is 12.7 to 18.1 kg. LILA and poor nutritional knowledge score more doubles the risk of mother "B" to give birth to low birth weight infants despite already full term gestation.

Examples of cases and the results of the statistical analysis showed that the nutritional status of the mother during pregnancy is seen from the increase in the ideal weight based on BMI table will give a better interpretation than the size of LILA. LILA and early pregnancy BMI is used as an initial screening to determine the ideal weight gain and maternal nutrition and education interventions should be given during pregnancy. Mothers who have a MUAC and BMI are good at the beginning of pregnancy, if not followed by ideal body weight according to the BMI early in pregnancy would be at risk of having a baby of low birth weight 11 times that of women with weight gain ideal.

Age of mother

Manuaba (2009) proposed under the age of 20 years and above 35 years of age who are considered at risk in pregnancy. This can lead to the onset of health problems at birth and risk of fetal birth defects and low birth weight. This is consistent with the results of the bivariate analysis that there is a relationship between the mother's age during pregnancy with the incidence of low birth weight ($p = 0.024$; OR = 3.777). In addition to age is too old (> 35 years), some cases of teenage pregnancy and unwanted pregnancy also contributes to the incidence of LBW in this area. Results of logistic regression analysis puts the age of the mother at the fourth major cause of low birth weight in the region of Puskesmas Panekan. These results can provide interpretation at the same time an intervention plan that the risk of pregnancy by age can be controlled, both in terms of prevention is to provide counseling to adolescents and mothers about the dangers of early pregnancy are too young or too old, and in terms of adequate assistance to the ANC during pregnancy ,

Parity

Parity is the number of deliveries ever experienced by a mother. The incidence of low birth weight and perinatal mortality generally increased with increasing maternal parity, especially when the parity of more than 3 (Winkjosastro 2008). Research by Bisai et al (2006) stated that the first parity had a 2.4 times higher risk than parity second or more to give birth to low birth weight babies. The results of research in the area of PHC Panekan, show different things that multiparous mothers (57.5%) more than the mother gave birth to low birth weight babies primipara (42.5%). There were no significant differences between primiparous mothers who give birth to babies with low birth weight primiparous mothers who gave birth to low birth weight infant, as well as multiparous mothers. There was no relationship between parity and incidence of low birth weight ($p = 0.822$). Causes of LBW is multifactorial. Parity is low or high is also not necessarily affect the health of the mother. Primiparous or multiparous mothers with no history of the illness, always maintain their health, maintain good nutritional intake, and consult regularly to a health worker during pregnancy will reduce the risk for having a baby of low birth weight.

Morbidities during pregnancy

There are many risks in terms of medical and obstetric affecting LBW, both divided between the detected prior to pregnancy, such as the chronically ill mother or a bad obstetric history, and which can only be observed during pregnancy, such as placenta previa or gestational diabetes mellitus (Kercher 2008). Maternal disease that causes low birth weight in the region of Puskesmas Panekan include hypertension, PER/PEB, KPD, placental abnormalities, heart disease and Intra Uterine Fetal Death (IUFD). In this study KPD, placental abnormalities, heart disease and Intra Uterine Fetal Death (IUFD) is not taken as sample. Morbidities during pregnancy has a close relationship with LBW ($p = 0.000$; OR = 23.222).

Logistic regression results put morbidities during pregnancy in the first rank ($p = 0.001$) of the causes of LBW in the region Puskesmas Panekan. Mothers with co-morbidities during pregnancy risk having the chance of having a baby of low birth weight 23 times than healthy mothers. Early detection and screening in early pregnan-cy, morbidities monitoring during pregnancy, mothers and educating public, as well as continuing assisting pregnant women with high risk is expected to be one way to prevent more severe complications and reduce the number of LBW in the region PHC Panekan.

Education

Several studies have explained that there is a relationship between maternal education with the incidence of low birth weight. Maternal education component into the socio-economic status in society. Kercher (2008) argues that several studies have noted that with increasing maternal education, the risk of decreased birth weight, but the explanation for this finding is often unclear. It can be hypothesized that the mother's education act indirectly by modifying the behavior of women's health in terms of initiation of prenatal care, smoking or food intake during pregnancy.

These results indicate different things that there is no relation between maternal education with LBW in the PHC Panekan (p = 0.263). It is then described by the research data that describes that although the mother has the status of higher education, but there are other factors that more strongly in favor of LBW, namely maternal morbidities during pregnancy and weight gain during pregnancy. Some women with good educational status are included in the group with health-risk or less weight gain during pregnancy. This multifactorial nature that should be observed, especially by health personnel not to ignore important factors that are interrelated in favor of the occurrence of LBW.

Work

Results of univariate analysis in this study shows that of the group of working mothers, 10 of them gave birth to low birth weight babies and 7 did not give birth to low birth weight babies. This number is smaller when compared with the incidence of low birth weight in the mother does not work or a housewife. Bivariate analysis results expressed no relationship between maternal work with LBW (p = 0.585). Work is related to socioeconomic status and physical activity mother. A study led by Kozhimannil et al (2012) from the School of Public Health, University of Minnesota, explained that there was no difference in the incidence of low birth weight on the basis of employment status, there is no difference in preterm delivery on the basis of employment status, but to predict the outcome Unfavorable remains to be seen through the other risk factors that are known (eg races) (Kozhimannil et al 2013).

The theory was in accordance with the results of this study, maternal employment is not related to the incidence of low birth weight in the region of Puskesmas Panekan. There are various other factors that are more important to increase the risk LBW in mothers who either work or do not work like the mother's age, co-morbidities during pregnancy, weight gain during pregnancy and knowledge about nutrition during pregnancy.

Family income

Family income is associated with socioeconomic status. Social economy strongly relates to the fulfillment of the needs of the community, among others, food, clothing, housing, education, health, and others. Results of bivariate analysis differs from the above theory that there was no correlation between family income with LBW in the PHC Panekan (p = 1.000). This is because the characteristics of the communities and regions in Panekan health center. Panekan Puskesmas region is located at the foot of Mount Lawu with fertile soil and crops were varied. This makes the most of its people are farmers and traders. Families with monthly income is low or below the UMK most have deposits yield in the form of paddy/rice consumed daily to meet the caloric needs and to meet the needs side dishes, most of the other communities have their own fields planted with vegetables or buy in the market with a relatively cheap price compared with the price of groceries in urban areas. Another study explained that socio-economic factors related to nutrition and perceptions of health can affect the incidence of LBW. This study showed different results, which is the same as jobs and education, earning an indirect factor which has an extremely small effect or even none at all with LBW due to the influence of other risk factors are more dominant.

Knowledge on nutrition

Results of bivariate analysis showed an association between maternal nutrition knowledge with LBW (p = 0.007; OR = 3.857). Mothers with more nutrition knowledge gave birth less LBW infants than mothers with the knowledge of good nutrition. Including nutrition knowledge is the knowledge of how to live a healthy pregnancy. It is the same as the studies conducted had by Viengsakhon et al (2010) about the factors that affect LBW in four hospitals in the center of Vientiane, which explained that mothers with inadequate levels of knowledge about healthy pregnancy practices 10.1 times higher risk of having a baby of low birth weight (95% CI = 6.7 to 15.2). Pregnant women who were in condition of undernutrition more prone to give birth to LBW with OR of 8.9 (95% CI = 5.6 to 14.3). Mother's knowledge about healthy pregnancy needs to be emphasized to reverse the trend of LBW.

CONCLUSION

Five variables were associated with LBW that MUAC, weight gain during pregnancy, maternal age, co-morbidities during pregnancy, and nutritional knowledge. Risk factors that mostly influence the incidence of low birth weight in the region of Puskesmas Panekan are comorbidities during pregnancy. Maternal nutritional status during pregnancy. Weight gain seen from the ideal according to table IMT will provide better interpretation than the size of LILA. LILA and early pregnancy BMI is used as an initial screening to determine the ideal weight gain and maternal nutrition and education interventions should be given during pregnancy. Socio-economic factors not always be the LBW factor. LBW causes are multifactorial. Another

risk factor is also important to be identified in order to prevent adverse pregnancy outcomes and provide interventions in accordance with the conditions of the mother and baby.

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