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Analysis of the causes of low-birth-weight infants in terms of nutritional status and maternal health history

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ABSTRACT

Introduction: The incidence of low-birth-weight infants is still high and requires serious attention to prevent infant mortality. This study aimed to analyze the causes of low-birth-weight infants' nutritional status and maternal health history.

Methods: This cross-sectional study was conducted in May to July 2021 at two hospitals in Surabaya. The study involved 498 mothers who had newborns within three years from 2019 and were recruited using simple random sampling. The inferential test was conducted using logistics regression with a significance level of 0.05.

Results: According to the adjusted model, variables that were significantly associated with the incidence of low-birth-weight infants were the husband's job as private worker (OR=0.021; 95% CI = 0.023-0.123), child number as one (OR=0.214; 95% CI = 0.114-3.428), parity as prime (OR=0.749; 95% CI = 0.197-3.652) and history of low-birth-weight infants in previous births (OR=0.015; 95% CI = 0.004-0.006).

Conclusions: Individual and family factors remand an essential variable in low-birth-weight prevalence. Nurses are responsible for providing socialization to mothers and fathers who are having and planning to have children. Cultural factors in the family and community where the mother lives also need to be carried out in further research.

Keywords: low birth weight infants; nutrition; history of illness; pregnancy

Introduction

Child development begins after conception or early pregnancy. Since then, mothers need to take care of their physical and psychological conditions so that the fetus they contain can grow and develop optimally (Evenson et al., 2014). Maternal nutrition is very influential on fetal growth and development. Undernourished mothers, before or during pregnancy, more often give birth to low birth weight (LBW) infants or are born with health problems (Stephenson et al., 2018). LBW is an Infant whose birth weight is less than 2500 grams. The incidence of LBW contributes to the neonatal mortality rate because of the various problems it causes. Infants with LBW are more at risk of experiencing health problems than term infants, so efforts are needed to prevent the occurrence of LBW (Dencker et al., 2016; Gilbert et al., 2019).

Since the fetus is in the womb until age 18, the government has carried out child health efforts with integrated antenatal care (ANC) programs, neonatal visits, immunizations, detection of growth and development, etc. This effort aims to prepare healthy, intelligent, and quality future generations and to reduce child mortality (Marangoni et al., 2016; Rogozinska et al., 2016). Child health efforts have shown good results, as seen in the child mortality rate from year to year, which shows a decline. The results of the Indonesia Demographic and Health Survey (IDHS) in 2017 showed a Neonatal Mortality Rate (NMR) of 15 per 1,000 live births, Infant Mortality Rate (IMR) of 24 per 1,000 live births, and Under-five Mortality Rate (U5MR) 32 per

1,000 live births. The Child Mortality Rate (CMR) has reached the 2030 Sustainable Development Goals (SDGs), which is 25/1,000 live births, and it is hoped that NMR can also reach the target of 12/1,000 live births (Schmidt et al., 2016).

IMR and Maternal Mortality Rate (MMR) are important indicators to determine the health status of the community. Indonesia is expected to reduce MMR and IMR to support the achievement of Sustainable Development Goals (SDGs), namely ending preventable maternal, infant, and under-five mortality, which is targeted for a Maternal Mortality Rate of 70 per 100,000 live births. For infants, 12 per 1000 live births and the under-five mortality rate is 25 per 1000 live births (Rauh et al., 2014). There is a tendency to decrease the proportion of birth weight to less than 2500 grams. In 2013, the proportion of LBW was 5.7, in 2018 it was 6.2. The National Mid-Term Development Plan (NMTDP) target in 2019 is 8%, but the 2016 National Health Indicator Survey (NHIS) results in the proportion being around 6.9%, while the percentage of LBW in Surabaya in 2018 was around 1.96 (Kennelly et al., 2016).

Based on the health profile of the Surabaya City Health Office, the IMR per 1,000 live births in Surabaya in 2018 was 6.43 per 1,000 live births. The percentage of LBW in Surabaya in 2018 was around 1.96 (Surabaya Health Office, 2019). From research on risk factors for LBW, the results show that the dominant factors that cause preterm labour include occupational factors at 0.385 times greater risk, pregnancy complications factors at 7.813 times greater risk, and antepartum bleeding factors at 26.886 times greater risk of preterm birth (Naja et al., 2016; van Dijk et al., 2017). Detection of LBW is also related to maternal education, which affects maternal health and the health of infants in the womb (Salsabiila et al., 2021). Knowledge of pregnant women is at risk of maternal anemia because pregnant women do not know nutritious foods to consume. Anemia in the mother also causes LBW (Figueiredo et al., 2018).

One of the risk factors for the occurrence of LBW infants is a history of high-risk maternal pregnancies. Estimates of pregnant women at high risk or complications in Surabaya in 2016 amounted to 9,496 people. The coverage of high-risk pregnant women or complications treated in health facilities is 90.24% (Naja et al., 2016). In addition to giving birth to LBW infants, pregnant women are at high risk, leading to uneven delivery/stuck, dead fetuses in the womb, pregnant women/maternal deaths, and so on.

The government has made various efforts to prevent the incidence of LBW, including integrated ANC during pregnancy and giving supplementary food to pregnant women with a Lack of Chronic Energy (LCE). Another effort that can be done is to detect pregnant women at risk of giving birth to LBW infants by collaborating with primary healthcare (Jones et al., 2014; Stang & Huffman, 2016). Unfortunately, there are still barriers that make the government's efforts still ineffective in preventing LBW. One of these barriers comes from internal factors of pregnant women. Thus, this study aimed to identify the factors that cause low birth weight in terms of nutritional status and maternal disease history.

Materials and Methods

Research Design

This type of research was included in the category of quantitative research with a cross-sectional approach. The study was conducted in May – July 2021 at Haji Hospital and Soewandi Hospital, Surabaya, on mothers who had newborns within three years from 2019. The study was conducted by analyzing the factors that cause low-birth-weight infants seen from nutritional status and maternal history during pregnancy.

Respondent

The population in this study were all newborns born at Soewandi Hospital and Haji Hospital Surabaya in the last three years, consisting of two groups, namely newborns weighing <2,500 grams and infants born weighing 2,500 grams or more. A total of 498 mothers with infants born were recruited using simple random sampling.

Research Variables

The variables of this study were factors that were reviewed from the mother's nutritional status, namely body mass index, upper arm circumference, hemoglobin levels, and consumption of supplements. While in terms of disease history, factors are parity, previous history of low birth weight, comorbidities, birth interval, history of smoking, and alcohol consumption. The dependent variable in this study was the incidence of low-birth-weight infants.

Data Collection and Research Instrument

Data collection was done by looking at the data through the mother's medical record during hospitalization and identifying according to the required category. Measurement of socio-demographic data was using a questionnaire consisting of age, education, occupation, income, husband's occupation, gestational age, and the number of children. Body mass index and upper arm circumference were measured using the

midline by measuring weight and height to calculate maternal body categories, which were classified into underweight <18.5 kg/m^2, Normal 18.5 – 25.9 kg/m^2, overweight 25 – 29.9 kg /m^2 and obesity > 30 kg/m^2. While the size of the upper arm circumference <23.5 cm was in the category of malnutrition. Hemoglobin levels were seen based on blood laboratory results with a high-risk category if <11 grams/dL, and supplement consumption was measured based on interviews with mothers. History of parity, previous LBW, comorbidities, pregnancy gap, history of smoking and alcohol consumption seen through the patient's medical record while in hospital.

Data Analysis

The data obtained were then carried out in descriptive data processing, with the frequency distribution of each variable studied and displayed based on percentages. The inferential test was carried out using the SPSS program for Windows version 22 and tested using Logistics Regression with a significance value of 0.05.

Ethical Consideration

Compliance with ethical guidelines. This research was first tested ethically and declared to have passed ethics at the Ethics Commission of Soewandi Hospital and Haji Hospital Surabaya with ethical worthy certificate numbers 003/KE/KEPK/2021 and 073/13/KOM.ETIK/2021.

Results

Sociodemographic Factors of Respondents

According to Table 1, the socio-demographic of respondents, namely mothers who gave birth at Haji Hospital and Soewandi Hospital, Surabaya with the most characteristic age 20-35 years, was as many as 361 respondents (72.5%). Educational history at the high school level as many as 254 respondents (51.0%). Most pregnant women do not work, as many as 460 respondents (92.4%), with the most income below the regional minimum wage, as many as 448 respondents (90.0%). A total of 460 respondents (92.4%) has a husband working in the private sector, and the maximum number of children is two children (57.6%).

Mother Nutrition Status

According to Table 1, nutritional status in mothers was measured by body mass index, upper arm circumference, hemoglobin level and consumption of supplements such as milk, blood-enhancing tablets, vitamins, and calcium in mothers during pregnancy. The body mass index of pregnant women was mostly in the normal category, total 268 respondents (53.8%), while women with abnormal conditions were underweight. A total 60 respondents (12.0%), overweight a total 108 respondents (21.7%), and obesity a total 62 respondents (12.4%). The arm circumferences of pregnant women who were less than normal (<23.5 cm) was 60 respondents (12.0%) and ≥ 23.5 cm are 438 respondents (88.0%), and the hemoglobin levels of pregnant women who were in anemic condition were 192 respondents (38.6%). Despite the abnormal nutritional status, there were still mothers who did not take pregnancy supplements, as many as 192 respondents (38.6%).

Maternal health history during pregnancy also contributes to the incidence of low-birth-weight infants, which includes a history of previous low-birth-weight

Table 1 Socio-demographic factors and mother health status (n=498)

Socio-demographic	Frequency (n)	Percentage (%)
Age		
Under 20 years	127	25.5
20 – 35 years	361	72.5
More than 35 years	10	2.0
Education		
Basic school	161	32.3
High school	254	51.0
University	83	16.7
Job		
Employed	38	7.6
Unemployed	460	92.4
Income		
Under and same as minimum regional income	448	90.0
Above minimum regional income	50	10.0
Husband's job		
Private Sectors	460	92.4
Civil Sectors	38	7.6
Child amount		
One child	194	40.0
Two children	287	57.6
Three or more children	17	3.4
Body Mass Index		
Underweight	60	12.0
Normal	268	53.8
Overweight	108	21.7
Obesity	62	12.4
Upper arm circumference		
< 23.5 cm	60	12.0
≥ 23.5 cm	438	88.0
Hemoglobin level		
Anemia	192	38.6
Normal	306	61.4
Supplement consumption		
No	192	38.6
Yes	306	61.4
Low-birth-weight infant history	170	34.1
Yes	195	39.2
No	133	26.7
Never gave birth		
Comorbid of illness		
Yes	263	52.8
No	235	47.2
Child Born alive		
Yes	240	48.2
No	258	51.8

infants and comorbidities. Most mothers were in a multi-parity condition with a history of low-birth-weight infants, as much as 34.1%. Mothers who had comorbidities were 52.8% consisting of gestational diabetes, hypertension, obesity, and asthma. Incidence of low-birthweight infants at Haji and Soewandi Hospitals Surabaya over the previous three years still showed poor results. As many as 48.2% of low-birth-weight infants were born alive from a vaginal birth or Sectio Caesarea. Unfortunately, 51.8% of low-birth-weight infants did not survive.

Cross-Tabulation of Socio-Demographic and Mother with Low-Birth-Weight Infant

The results of cross-tabulation of socio-demographic factors, nutritional status and history of maternal disease with the incidence of low-birth-weight infants showed that at risky ages, namely under 20 years and above 35 years, 70 respondents (14.1%) gave birth to low-birth-weight infants. Mothers with basic education, namely elementary school and junior high school, showed the most births of infants with low-birth weight, a total 108 respondents (21.3%). The highest number of children showed the incidence of low-birth-weight infants as much as 46.8% on nutritional factors, the incidence of mothers giving birth to children with low infant weight is almost balanced, both in normal and less than normal conditions. Deficiency of hemoglobin level (anemia) also contributed to the risk of 48.2%. Mothers who did not take supplements during pregnancy had a 15.5% incidence. Mothers with a history of giving birth to low-birth-weight infants had an incidence of 28.7%, and mothers with comorbidities had an incidence rate of 28.1%. In contrast, in mothers with a history of smoking and drinking alcohol, the incidence of low-birth-weight infants is 50% (from two mothers who smoke and drink alcohol). One mother drinking alcohol gave birth to a low-birth-weight infant (Table 2).

Low-birth-weight Infants based on Nutritional Status and Maternal Disease History

Based on Table 3 concerning to the results of the logistic regression analysis of factors for low-birth-weight infants in terms of nutrition in terms of

Table 2. Cross-tabulation of socio-demographic and mother with low-birth-weight infant

Factors Variable	Low-birth-weight infant		p-value
	No	Yes	
Age			
Under 20 years	61 (12.2%)	66 (13.3%)	
20 – 35 years	191 (38.4%)	170 (34.1%)	0.557
More than 35 years	6 (1.2%)	4 (0.8%)	
Educational background			
Basic school	52 (10.5%)	108 (21.7%)	
High school	150 (30.2%)	24 (4.8%)	0.000*
University	56 (11.3%)	27 (3.4%)	
Number of children			
One child	77 (15.5%)	117 (23.5%)	
Two children	171 (34.3%)	116 (23.3%)	0.000*
Three children or more	10 (2%)	7 (1.4%)	
Body mass index			
Underweight	29 (5.8%)	31 (6.2%)	
Normal	142 (28.5%)	126 (25.3%)	0.091**
Overweight	62 (12.4%)	46 (9.2%)	
Obesity	25 (5.0%)	37 (7.4%)	
Upper arm circumference			
< 23.5 cm	29 (5.8%)	31 (6.2%)	0.566
≥ 23.5 cm	229 (46.0%)	209 (42.0%)	
Hemoglobin level			
Anemia	115 (23.1%)	77 (15.5%)	0.004*
Normal	143 (28.7%)	163 (32.7%)	
Supplement consumption			
No	115 (23.1%)	77 (15.5%)	0.004*
Yes	143 (28.7%)	163 (32.7%)	
Parity			
Prime parity	77 (15.5%)	117 (23.5%)	0.000*
Multi parity	181 (35.4%)	123 (24.7%)	
Low-birth-weight infant history			
Yes	27 (5.4%)	143 (28.7%)	0.000*
No	168 (33.7%)	27 (5.4%)	
Never giving birth	63 (12.7%)	70 (14.1%)	
Comorbid of illness			
Yes	123 (24.7%)	140 (28.1%)	0.017*
No	135 (27.1%)	100 (20.1%)	
Pregnancy gap			
Under 2 years	18 (6.1%)	11 (3.7%)	0.860
≥ 2 years	160 (54.4%)	105 (35.7%)	

* P = <0.05
** P = <0.1

nutritional status, and maternal disease history. Out of twenty-one variables only four variables are associated with low birth weight, those variables consist of the husband's job, the number of children, parity, and history of low-birth-weight, each of that variable calculation are explained as follow according to the adjusted model above, each of these variables associated with the incidence of low-birth-weight babies is the husband's job which consists of the private sector (OR = 0.021, 95% CI = 0.023 – 0.123). Number of children that include one child (OR = 0.214, 95% CI = 0.114 – 3.428) and two children (OR = 0.309, 95% CI = 0.156 – 2.431), parity that consisted of prime parity (OR = 0.749. 95% CI = 0.197 – 3.652), history of low-birth-weight babies in previous birth consisted of experience low-birth-weight (OR = 0.015, 95% CI = 1.006 – 1.073).

Discussions

Low-birth-weight infants often occur at birth at any time if the mother's condition and factors that cause high risk are not immediately addressed. One of the main causes that often occur is due to maternal factors, especially problems related to pregnancy and nutritional status. Based on the study's results, it was found that the factors that are more likely to influence the incidence of low birth weight are the husband's job, the number of children, the incidence of parity, and low birth weight history.

A husband's job is closely associated with the incidence of low birth weight (Husanah & Machdalena, 2019). Husbands who do not earn or have insufficient income cannot meet the needs of their pregnant wives, such as the need for additional nutrition and vitamins for

Table 3. The results of the logistic regression analysis of factors for low-birth-weight infants in terms of nutritional status and maternal disease history (N=498)

Factors Contributed	Odds Ratio	95% CI		p-value
		Lower	Upper	
Age				
Under 20 years (ref)	1			
20 – 35 years	1.270	0.512	0.178	0.334
35 years and above	1.560	0.786	4.899	0.456
Educational background				
Basic school (ref)	1			
High school	1.670	0.782	4.112	0.925
University	0.998	0.332	5.543	0.772
Husband's job				
Civil sectors	1			
Private sectors	0.021	0.023	0.123	0.020*
Number of children				
One child	0.214			
Two children	0.309	0.114	3.428	0.021*
Three or more children	1	0.156	2.431	0.011*
Body mass index				
Underweight	1			
Normal	1.321	0.436	3.212	0.123
Overweight	1.742	0.055	2.412	0.228
Obesity	1.002	0.321	3.781	0.451
Upper arm circumference				
< 23.5 cm	1			
≥ 23.5 cm	1.379	0.386	6.312	0.410
Hemoglobin level				
Anemia	1			
Normal	1.901	0.903	2.114	0.432
Supplement consumption				
No	1			
Yes	1.650	0.907	1.219	0.690
Parity				
Multi parity	1			
Prime parity	0.749	0.197	3.652	0.040*
History of Low-birth-weight infant				
Yes	0.015	0.006	1.073	0.010*
No	0.005	0.004	0.006	0.441
Never	1			
Comorbid of illness				
Yes	1			
No	1.131	0.112	4.460	0.790
Pregnancy gap				
Under 2 years	1			
≥ 2 years	0.450	0.997	2.901	0.145

* P = <0.05

pregnant women (Elaabsi et al., 2022; Merklinger-Gruchala et al., 2019). Another thing that causes the husband's job to be at risk for making LBW is the limited cost of conducting routine pregnancy check-ups (ANC) (Rm et al., 2020). This burden increases if the spouse of the jobless father already has dependent children from previous births (Hinkle et al., 2014; Merklinger-Gruchala et al., 2019). Husband's jobs whose salary cannot meet their daily needs will also make pregnant women stressed. The level of stress will affect the mother's health problems; the hormone cortisol, which is produced as a chemical mediator in the body, makes the sympathetic and parasympathetic nerves work more, accordingly, it will also have an impact on the fetus in the womb (Rauh et al., 2014; Schmidt et al., 2016).

The number of children and the incidence of parity cause the birth of low-birth-weight infants as much as six times more than other factors. The number of children and the number of parities that pose a high risk of having an infant are mothers with more children or who have given birth for the first time. The risk of mothers with too many children, especially at such a close distance between pregnancy and child-birth, makes the condition of the mother's uterus not fully ready for implantation of the fertilized fetus (Razeeni et al., 2021). The mother's uterus takes about two years to prepare to receive new implantation to be more fertile in maintaining the fetus to stay healthy because a properly regenerated uterus will make the placenta stick firmly so that the circulation of air, blood, and nutrients from mother to child is not disturbed (Jelsma et al., 2016; Zhang et al., 2014).

Previous low birth weight history in the mother is also more likely to have been associated with the incident of low birth weight. This condition is closely related to the mother's nutritional status during pregnancy (Desta et al., 2020). Mothers who experience CED will risk giving birth to children with low birth weight. CED in pregnant women can not only cause severe nausea and vomiting, weakness, and fatigue but is also dangerous for the fetus because of the risk of miscarriage, low birth weight, premature birth, stunting, also giving birth to infants who also experience chronic energy deficiency later (Aisy & Kurniasari, 2022; Girma et al., 2019). Therefore, chronic energy deficiency in pregnant women needs to be detected and treated early so that the fetus born later can be healthier. This CED can have many possible triggers, including stress, viral infections, weak immunity, and hormonal balance disorders (Deriba & Jemal, 2021; Diani et al., 2020).

If a pregnant woman with CED gets pregnant again and her CED has not been handled properly, then there is a great risk that she will experience problems with the fetus again, as mentioned above. Therefore, before planning another pregnancy, pregnant women with a history of CED are advised to consult with their obstetrician and nutritionist to handle their condition optimally. That way, she can contain a healthier fetus in her next pregnancy.

Conclusions

Generally, the results of this study highlight the need to improve the level of knowledge and increase the trust in the COVID-19 vaccines to expedite their uptake in the older adult population. Educating them on the benefits of the COVID-19 vaccine is an essential milestone in preventing further morbidity and mortality cases of the COVID-19 disease, considering their high-risk category. Moreover, the local government should intensify its public awareness campaigns to reach everyone in the community. Providing rewards or incentives can also be a strategy to improve the level of vaccine uptake.

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References

Aisy, R. rahadatu., & Kurniasari, L. (2022). Hubungan Riwayat Persalinan dan Riwayat Bblr dengan Kejadian Stunting pada Anak. *Literature Review. Borneo Student Research*, *3*(2), 1734–1745.

Dencker, A., Premberg, Å., Olander, E. K., McCourt, C., Haby, K., Dencker, S., Glantz, A., & Berg, M. (2016). Adopting a healthy lifestyle when pregnant and obese - an interview study three years after childbirth. *BMC Pregnancy and Childbirth*, *16*(1). https://doi.org/10.1186/s12884-016-0969-x

Deriba, B. S., & Jemal, K. (2021). Determinants of Low Birth Weight Among Women Who Gave Birth at Public Health Facilities in North Shewa Zone : Unmatched Case-Control Study. *The Journal of Health Care Organization, Provision, and Financing*, *58*(2021), 1–11. https://doi.org/10.1177/00469580211047199

Desta, S. A., Damte, A., & Hailu, T. (2020). Maternal factors associated with low birth weight in public hospitals of Mekelle city , Ethiopia : a case-control study. *Italian Journal of Pediatric*, *46*(124), 1–9. https://doi.org/10.1186/s13052-020-00890-9

Diani, M. W., Mogi, A. K., & Rahmi, K. A. (2020). Differentiate Factors of Pregnant Women with Chronic Energy Deficiency Occurrence In Bajulmati Village, Wongsorejo District, Banyuwangi Regency 2019. *Journal of Community Medicine and Public Health Research*, *1*(1), 24–32. https://doi.org/10.20473/jcmphr.v1i1.20297

Dijk, M. R., Oostingh, E. C., Koster, M. P. H., Willemsen, S. P., Laven, J. S. E., & Steegers-Theunissen, R. P. M. (2017). The use of the mHealth program Smarter Pregnancy in preconception care: Rationale, study design and data collection of a randomized controlled trial. *BMC Pregnancy and Childbirth*, *17*(1). https://doi.org/10.1186/s12884-017-1228-5

Elaabsi, M., Loukid, M., & Lamtali, S. (2022). Socio-economic and cultural determinants of mothers and fathers for low birth weight newborns in the region of Marrakech (Morocco): A case-control study. *PLOS ONE*, *17*(6), 269832.

https://doi.org/10.1371/journal.pone.0269832

Evenson, K. R., Barakat, R., Brown, W. J., Dargent-Molina, P., Haruna, M., Mikkelsen, E. M., Mottola, M. F., Owe, K. M., Rousham, E. K., & Yeo, S. A. (2014). Guidelines for Physical Activity During Pregnancy: Comparisons From Around the World. *American Journal of Lifestyle Medicine*, *8*(ue 2), 102–121. https://doi.org/10.1177/1559827613498204

Figueiredo, A. C. M. G., Gomes-Filho, I. S., Silva, R. B., Pereira, P. P. S., Mata, F. A. F. D., Lyrio, A. O., Souza, E. S., Cruz, S. S., & Pereira, M. G. (2018). No Title. *Maternal Anemia and Low Birth Weight: A Systematic Review and Meta-Analysis. Nutrients*, *10*(5). https://doi.org/10.3390/nu10050601

Gilbert, L., Gross, J., Lanzi, S., Quansah, D. Y., Puder, J., & Horsch, A. (2019). How diet, physical activity and psychosocial well-being interact in women with gestational diabetes mellitus: An integrative review. *BMC Pregnancy and Childbirth*, *19*(1). https://doi.org/10.1186/s12884-019-2185-y

Girma, S., Fikadu, T., Agdew, E., Haftu, D., Gedamu, G., & Dewana, Z. (2019). Factors associated with low birthweight among newborns delivered at public health facilities of Nekemte town , West Ethiopia : a case control study. *BMC Pregnancy and Childbirth*, *19*(220), 1–6. https://doi.org/10.1186/s12884-019-2372-x

Hinkle, S. N., Albert, P. S., Mendola, P., Sjaarda, L. A., Yeung, E., Boghossian, N. S., & Laughon, S. K. (2014). The Association between Parity and Birthweight in a Longitudinal Consecutive Pregnancy Cohort. *Paediatric and Perinatal Epidemiology*, *28*(2), 106–115. https://doi.org/10.1111/ppe.12099

Husanah, E., & Machdalena, M. (2019). Perilaku Suami Berhubungan dengan Kejadian Bayi Berat Lahir Rendah (BBLR) di Arifin Achmad Pekanbaru. *Prosiding Hang Tuah Pekanbaru*, *1*(1), 71–76. https://doi.org/10.25311/prosiding.Vol1.Iss1.18

Jelsma, J. G. M., Leeuwen, K. M., Oostdam, N., Bunn, C., Simmons, D., Desoye, G., Corcoy, R., Adelantado, J. M., Kautzky-Willer, A., Harreiter, J., Assche, F. A., Devlieger, R., Timmerman, D., Hill, D., Damm, P., Mathiesen, E. R., Wender-Ozegowska, E., Zawiejska, A., Rebollo, P., & Poppel, M. N. M. (2016). Beliefs, Barriers, and Preferences of European Overweight Women to Adopt a Healthier Lifestyle in Pregnancy to Minimize Risk of Developing Gestational Diabetes Mellitus: An Explorative Study. *Journal of Pregnancy*. https://doi.org/10.1155/2016/3435791

Jones, I., Chandra, P. S., Dazzan, P., & Howard, L. M. (2014). Bipolar disorder, affective psychosis, and schizophrenia in pregnancy and the post-partum period. *The Lancet*, *384*(ue 9956), 1789–1799. https://doi.org/10.1016/S0140-6736(14)61278-2

Kennelly, M. A., Ainscough, K., Lindsay, K., Gibney, E., Mc Carthy, M., & McAuliffe, F. M. (2016). Pregnancy, exercise and nutrition research study with smart phone app support (Pears): Study protocol of a randomized controlled trial. *Contemporary Clinical Trials*, *46*, 92–99. https://doi.org/10.1016/j.cct.2015.11.018

Marangoni, F., Cetin, I., Verduci, E., Canzone, G., Giovannini, M., Scollo, P., Corsello, G., & Poli, A. (2016). Maternal diet and nutrient requirements in pregnancy and breastfeeding. An Italian consensus document. *Nutrients*, *8*(ue 10)). https://doi.org/10.3390/nu8100629

Merklinger-Gruchala, A., Jasienska, G., & Kapiszewska, M. (2019). Paternal investment and low birth weight – The mediating role of parity. *PLOS ONE*, *14*(1), 210715. https://doi.org/10.1371/journal.pone.0210715

Naja, F., Nasreddine, L., Al Thani, A. A., Yunis, K., Clinton, M., Nassar, A., Farhat Jarrar, S., Moghames, P., Ghazeeri, G., Rahman, S., Al-Chetachi, W., Sadoun, E., Lubbad, N., Bashwar, Z., Bawadi, H., & Hwalla, N. (2016). Study protocol: Mother and Infant Nutritional Assessment (MINA) cohort study in Qatar and Lebanon. *BMC Pregnancy and Childbirth*, *16*(1). https://doi.org/10.1186/s12884-016-0864-5

Rauh, K., Kunath, J., Rosenfeld, E., Kick, L., Ulm, K., & Hauner, H. (2014). Healthy living in pregnancy: A cluster-randomized controlled trial to prevent excessive gestational weight gain - rationale and design of the GeliS study. *BMC Pregnancy and Childbirth*, *14*(1). https://doi.org/10.1186/1471-2393-14-119

Razeeni, D. M. A., Al-Wathinani, A., Alhazmi, R., Samarkandi, O. A., Aditya, R. S., Salameh, B., & Alenazi, A. (2021). The Preparedness of Emergency Medical Services Students for Coronavirus Disease 2019: A Cross-Sectional Study among Paramedic Students. *Indian Journal of Pharmaceutical Sciences*, *5*(October).

Rm, C. M., Ba, A. W., & Bsocsc, B. C. (2020). Barriers and facilitators perceived by women while homeless and pregnant in accessing antenatal and or postnatal healthcare : A qualitative evidence synthesis. *February*, 1380–1393. https://doi.org/10.1111/hsc.12972

Rogozinska, E., D'Amico, M. I., Khan, K. S., Cecatti, J. G., Teede, H., Yeo, S., Vinter, C. A., Rayanagoudar, G., Barakat, R., Perales, M., Dodd, J. M., Devlieger, R., Bogaerts, A., Poppel, M. N. M., Haakstad, L., Shen, G. X., Shub, A., Luoto, R., Kinnunen, T. I., & Thangaratinam, S. (2016). Development of composite outcomes for individual patient data (IPD) meta-analysis on the effects of diet and lifestyle in pregnancy: A Delphi survey. *BJOG: An International Journal of Obstetrics and Gynaecology*, *123*(ue 2), 190–198. https://doi.org/10.1111/1471-0528.13764

Salsabiila, J. H., Joewono, H. T., & Sulistiawati, S. (2021). Maternal Educational Status as One of the Risk Factors Affecting the Incidence of Infants with Low Birth Weight in Dr. *M. Soewandhie General Hospital Surabaya. JUXTA: Jurnal Ilmiah Mahasiswa Kedokteran Universitas Airlangga*, *12*(1), 10. https://doi.org/10.20473/juxta.v12i12021.10-13

Schmidt, M. I., Duncan, B. B., Castilhos, C., Wendland, E. M., Hallal, P. C., Schaan, B. D. A., Drehmer, M., Costa, Forti, A., Façanha, C., & Nunes, M. A. (2016). Lifestyle INtervention for Diabetes prevention After pregnancy (LINDA-Brasil): Study protocol for a multicenter randomized controlled trial. *BMC Pregnancy and Childbirth*, *16*(1). https://doi.org/10.1186/s12884-016-0851-x

Stang, J., & Huffman, L. G. (2016). Position of the Academy of Nutrition and Dietetics: Obesity, Reproduction, and Pregnancy Outcomes. *Journal of the Academy of Nutrition and Dietetics*, *116*(4), 677–691. https://doi.org/10.1016/j.jand.2016.01.008

Stephenson, J., Heslehurst, N., Hall, J., Schoenaker, D. A. J. M., Hutchinson, J., Cade, J. E., Poston, L., Barrett, G., Crozier, S. R., Barker, M., Kumaran, K., Yajnik, C. S., Baird, J., & Mishra, G. D. (2018). Before the beginning: nutrition and lifestyle in the preconception period and its importance for future health. *The Lancet*, *391*(ue 10132), 1830–1841. https://doi.org/10.1016/S0140-6736(18)30311-8

Zhang, C., Tobias, D. K., Chavarro, J. E., Bao, W., Wang, D., Ley, S. H., & Hu, F. B. (2014). Adherence to healthy lifestyle and risk of gestational diabetes mellitus: Prospective cohort study. *BMJ (Online*, *349*. https://doi.org/10.1136/bmj.g5450

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