

Maternal risk factors for low birth weight infants: A systematic review study

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Abstract

Background: More than 80% of newborn deaths are low birth weight babies. The cause of most neonatal deaths in Indonesia in 2021 was the condition of low birth weight babies (LBW) at 34.5%. The availability and quality of LBW data varies greatly between countries, so to achieve the target of reducing LBW, more data and good quality data are needed. This study aimed to review the evidence linking risk factors for LBW using a systematic review study.

Methods: Articles published in 2020-2023 in google scholar, pubmed and science direct databases were systematically reviewed. Eight articles that met the inclusion and exclusion criteria were included as samples for further review. Results on maternal risk factors for LBW were synthesized systematically.

Results: From the search results, 756 articles were obtained, after the screening process, the final result was 8 articles. Risk factors that were significantly associated with LBW in the articles were grouped into subthemes, including: maternal age, parity, pregnancy spacing, education, occupation, residence, body mass index, weight gain, anemia, gestational age below 37 weeks, smoking, preeclampsia, adverse obstetric history, medical examination, pregnancy danger signs and history of adenomyosis,

Conclusion: The various risk factors identified indicate that the target of reducing LBW rates must take many approaches. The diversity of data on risk factors is expected to help determine the distribution of causes and interventions for the handling and prevention of LBW.

Keywords: Maternal; Risk Factors; Low birth weight; Newborn

1. Introduction

The World Health Organization (WHO) defines low birth weight (LBW) as birth weight less than 2500 grams regardless of gestational age. LBW is an indicator of public health problems that include long-term maternal malnutrition, poor maternal health conditions and care during pregnancy [1]. More than 80% of newborn deaths are low birth weight babies, of which two-thirds are premature and one-third are small for gestational age. The most common causes of neonatal death in Indonesia in 2021 were low birth weight (LBW) at 34.5% and asphyxia at 27.8%[2]. Individually, these are important predictors of newborn health and survival. Problems with LBW can have both short-term and long-term adverse effects on the health of the child. Compared to infants born at normal weight, LBW are more at risk of stunting, lower intellectual intelligence and childhood mortality. As well as being more at risk of overweight, obesity, heart disease, diabetes and other non-communicable diseases [3].

Reducing LBW is a health priority set in the Global Nutrition Targets in 2012, and has become a global commitment. The World Health Assembly (WHA), set a target of reducing LBW by 30 percent by 2025. This is a major challenge despite

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ongoing efforts to strengthen national surveillance systems. The availability and quality of LBW data varies widely across countries, so achieving the target of reducing LBW requires more data and better quality data [3].

Many studies and literature describe risk factors for low birth weight, providing insight into conditions that may increase the incidence of LBW. LBW is not only associated with baseline maternal characteristics during pre-pregnancy, but also potential risk factors during pregnancy, including maternal age, education level, lifestyle, health status, and disease, where maternal age, education level, and marital status are more closely associated with LBW[4–6]. This article aims to review the evidence linking risk factors for LBW using systematic review studies.

2. Methods

This research uses a systematic review study conducted by searching articles on google scholar, pubmed and science direct. Search keywords using Boolean Operators include OR/AND/NOT. The literature search terms used were Neonate OR Newborn AND "Low Birth Weight" OR "LBW" OR "Birth Weight" OR "Born Weight" AND "Risk Factor" OR "Maternal Risk Factor". The inclusion criteria were articles published in 2020-2023, the literature sources used in the preparation of the article were taken from 3 articles consisting of international journals. The selection of literature source articles is carried out by assessing the quality and results of studies that discuss risk factors for LBW incidence in 2020-2023, articles in English, full text literature and free access. Articles derived from non-research studies including systematic reviews were not included in this study.

2.1. Quality Assessment

The study quality assessment used the CASP checklist which is used to critically assess the study which includes the validity of the research, the accuracy of the research results and the benefits of the research to be applied in the field. The quality assessment tool uses a number of questions according to the research design so that it can be assessed whether the study can be used as quality evidence.

2.2. Analysis and synthesis

The results on risk factors leading to LBW in each article were grouped under the same subtheme.

3. Results and discussion

A total of 756 articles were obtained, after the screening process, 8 articles were obtained. the final result is 8 articles. The articles obtained represent various countries, among others: 8 articles conducted in the African continent (Ethiopia and Morocco), the Asian continent (Japan, India and Nepal) and Europe (Slovakia).

Table 1 Literature Review of Factors Affecting LBW

No	Title, Author, Year	Setting	Design, Sample and Variables	Results
1.	Population attributable fraction of risk factors for low birth weight in the Japan Environment and Children's Study (Nishihama, Nakayama, and Tabuchi 2022)	Japan	Observational Cohort Sample: 91,559	Significant risk factors: Primiparous parity History of adenomyosis Hypertension in pregnancy Maternal age at delivery ≥ 40 years BMI before pregnancy < 18.5 Weight gain during pregnancy Mother smoking
2.	Risk factors for low birth weight in El Jadida province, Morocco. Case-control study (Elfane et al. 2022)	Maroko	Observational Case Control Sample: Case group: 156 Control group: 156	Significant risk factors: female illiteracy secondary education level pregnancy check-up < 4 times normal BMI Obese BMI

				Did not receive nutrition education
3.	Determinants of low birth weight among newborns delivered at Tirunesh Beijing General Hospital, Addis Ababa, Ethiopia: a casecontrol study (Tadese et al. 2021)	Ethiopia	Observational Case control Sample: Case group 151 Control group 302	Risk factors associated with significant LBW: Rural residence Trader occupation Pregnancy danger signs Weight gain during pregnancy 50-60 kg
4	Effects of inter-pregnancy intervals on preterm birth, low birth weight and perinatal deaths in urban South Ethiopia: a prospective cohort study (Jena et al. 2022)	Ethiopia	Cohort study Sample: 2578	Risk factors associated with significant LBW: Pregnancy spacing less than 18 months
5	Epidemiological determinants of low birth weight: A prospective study (Kouser et al. 2020)	India	Cohort study Sample: 364	Risk factors associated with significant LBW: Socioeconomic status Maternal height Anemia Twin pregnancy
6	Low birth weight and its associated risk factors: Health facility-based case-control study Low birth weight and its associated risk factors: Health facility-based case-control study (C, Basel, and Singh 2020)	Nepal	Observational Case control Sample: Case group 123 Control group 246	Risk factors associated with significant LBW: Place of residence Iron tablet consumption less than 180 tablets Weight gain Comorbid diseases during pregnancy Premature labor
7	Risk Factors Associated With Low Birth Weight (Diabelková et al. 2022)	Slovak Republic	Kohort study Sampel: 1946	Risk factors associated with significant LBW: Low education Marital status/single parent Less than 8 ANC visits Premature labor
8	The Prevalence of Low Birth Weight Among Newborn Babies and Its Associated Maternal Risk Factors: A Hospital-Based Cross-Sectional Study (Devaguru et al. 2023)	Japan	Cross-sectional study Sampel: 327	Risk factors associated with significant LBW: Maternal weight and height Age Parity Weight gain during pregnancy Anemia during pregnancy

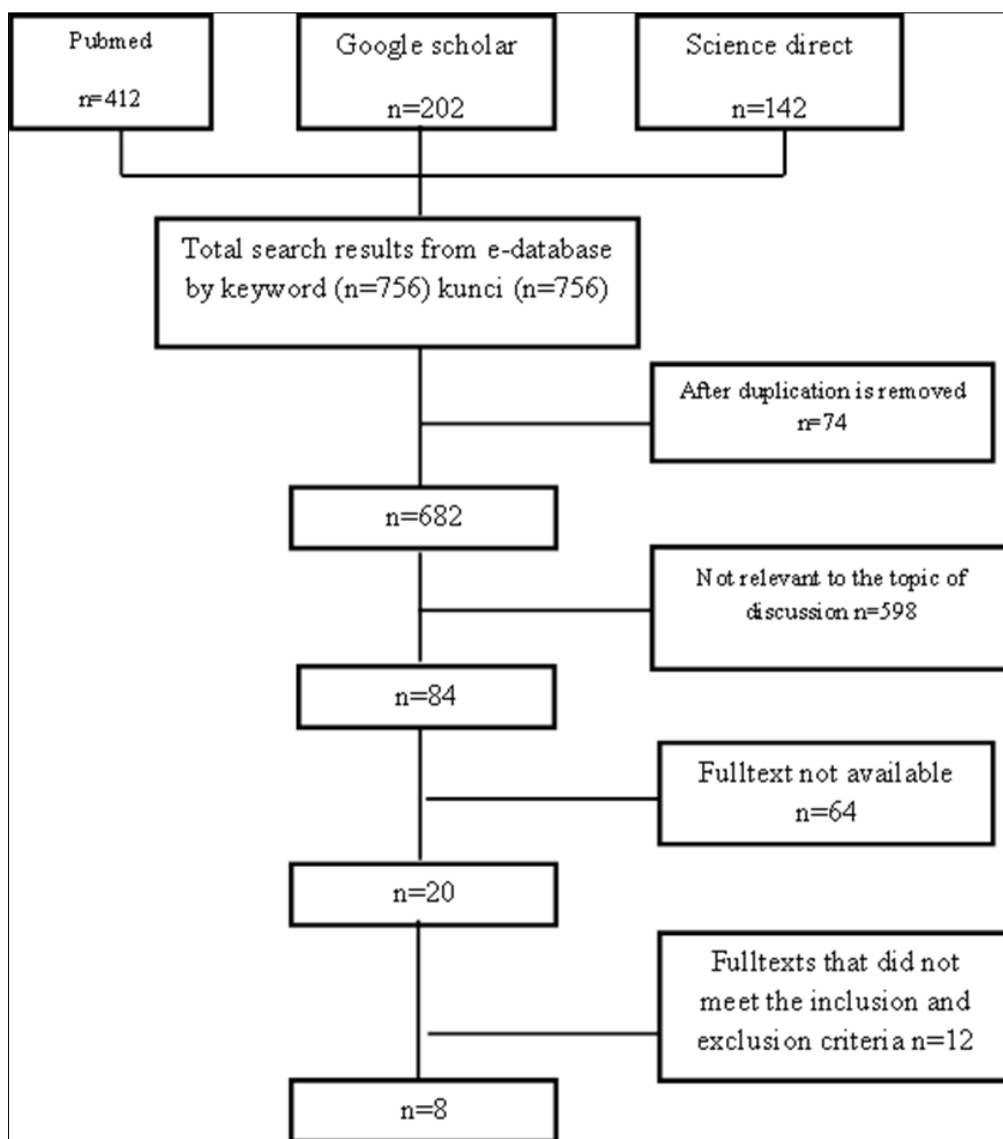


Figure 1 Flow Chart of Selection Process

From the 8 studies that became the source of literature, the factors that significantly influenced the incidence of LBW were discussed:

3.1. Age

The age of the mother during pregnancy was calculated from the date of birth until the current pregnancy. Maternal age was categorized as at-risk (<20 years or >35 years) and not at-risk (20 - 35 years). Maternal age at delivery is known to be associated with infant birth weight. At-risk mothers aged <20 years and >35 years tend to have a higher risk than those aged 20-35 years. This is consistent with previous studies [4, 5].

3.2. Education

Education according to Law No. 20/2003 is formal education, which is a structured and tiered education path consisting of basic education (elementary / junior high school / junior high school equivalent), secondary education (high school / junior high school / vocational high school equivalent), and higher education. Education is the main factor that plays a role in a person's knowledge and insight. The higher the mother's education, the better her knowledge and the easier it is to receive information. Ease of obtaining information and education about nutritional needs and pregnancy can also be obtained through nutritional counseling during the preparation period and during pregnancy. Low maternal education is associated with socioeconomic status, which also affects the fulfillment of nutritional needs and social

support during pregnancy. Mothers who are illiterate and have completed primary education are more at risk of giving birth to LBW than mothers with secondary and university education [6, 7].

3.3. Parity

Parity is the number of births experienced by the mother, both live and non-live births, but excluding miscarriages. Research results vary on the relationship between parity and the incidence of LBW. Mekie and Taklual stated that women with a first pregnancy have an 83% reduced risk of delivering LBW babies compared to those with 5 or more pregnancies [8]. Another 10-year Korean study showed that LBW rates tended to be higher in first births than second and third births, and then increased as the birth order increased to more than [4]. The Japan Environment and Children's Study (JECS) through a study updated every 4 years showed that primiparous mothers were more likely to have LBW than multiparous mothers [5].

3.4. Pregnancy spacing

Pregnancy spacing, is the interval between two consecutive births of a woman. Most studies from around the world show that the gap between a woman's birth and her next pregnancy is directly related to the risk of infant, child and maternal mortality. In addition, pregnancies that are too closely spaced also carry a higher risk of preterm birth and low birth weight for the baby, as well as complications related to maternal pregnancy and birth, such as anemia and obstetric fistula [9].

3.5. Anemia

Anemia in pregnant women can cause disruption in the delivery of oxygen and food substances from the mother to the placenta and fetus. This leads to decreased placental function which impacts the growth and development of the fetus. Monitoring hemoglobin levels in pregnant women can identify mothers who are malnourished which can adversely affect the fetus, prevention and treatment of anemia has a significant impact on the incidence of LBW [10].

3.6. Gestational age less than 37 weeks

Gestational age plays an important role in determining birth weight. WHO estimates that about one-third of all LBW in the world is due to prematurity. It is clear that babies born before term, whether due to gynecological or medical factors, are at a higher risk of being born LBW, because at <37 weeks the fetus has not yet reached the optimal growth and developmental time

3.7. Maternal weight gain during pregnancy

Maternal weight gain during pregnancy varies according to BMI, excessive and insufficient gain is associated with low birth weight babies small for gestational age (SGA), large for gestational age (LGA), macrosomia, cesarean delivery, gestational diabetes mellitus (GDM). In total, the IOM recommends weight gain of 12.5 to 18 kg for lean women; 11.5 to 16 kg for normal weight women, 7 to 11 kg for overweight women and 5 to 9 kg for obese women [11]

3.8. Smoking

Pregnant mothers who smoke are harmful to the well-being of the fetus in the womb, this is associated with exposure to harmful substances in the blood that cause unfavorable birth outcomes. Babies born to mothers who are active smokers have a higher risk of premature birth and low birth weight than babies born to passive smokers and non-smokers [7, 12].

3.9. Body Mass Index

The nutritional status of pregnant women before and during early pregnancy is crucial for cell differentiation and organogenesis. Nutritional conditions and body mass index (BMI) that are not optimal during this period can cause disruption and delayed fetal growth. Based on the 2009 Institute of Medicine (IOM) guidelines, maternal body mass index is calculated by dividing body weight in kilograms by height in meters squared [13]. Chronic energy deficiency (CED) is a condition where the body lacks nutrients (calories and protein) that lasts long and chronic, CED pregnant women will appear thin and the results of upper arm circumference (LILA) measurements are less than 23.5cm. LILA measurement as an indicator of nutritional status has the greatest potential use where scales are not available as it is easy and reliable to perform. The main advantage of LILA measurement is that its use is already widespread in many countries. Conditions of SEZ in pregnant women risk the incidence of prolonged partus and postpartum hemorrhage, up to maternal death. The risk to the baby can cause fetal death, abortion, prematurity, birth defects, low birth weight

(LBW) and infant mortality. The results of the study showed that LILA was strongly correlated with the incidence of LBW [14].

3.10. Health Checkup

Health checks before and during pregnancy are important things that should be done by the mother to know her health condition. Detection of various diseases during pregnancy, chronic diseases, infectious diseases and the welfare of the fetus in the womb. The Ministry of Health's guidelines for antenatal care/ANC services stipulate that mothers should have at least 6 antenatal check-ups. Less than standard antenatal check-ups are associated with an increased risk of LBW [15]

3.11. Poor obstetric history

Obstetric history includes outcomes of previous pregnancies or maternal and fetal complications. The presence of danger signs in pregnancy is associated with low birth weight, premature birth outcomes and even death. The study by Tadese et al. concluded that not only obstetric conditions during the current pregnancy affect birth outcomes, but poor previous obstetric history is considered a factor affecting the re-occurrence of the same birth outcome [16].

3.12. Pregnancy danger signs

Pregnancy danger signs are signs/symptoms that indicate the mother and baby are in danger. If there are danger signs, the mother must immediately get help at the nearest health facility. Among the danger signs of pregnancy are not wanting to eat and vomiting constantly, having a high fever, less fetal movement in the womb, some parts of the body swell, bleeding and premature rupture of amniotic fluid [15]

3.13. Work/physical activity

Work, the main activity carried out by humans to meet their needs, is family workers / housewives, laborers / employees / employees and entrepreneurs. Pregnant women who work have a greater risk of being exposed to various pregnancy problems than housewives/family workers. The environmental conditions of the workplace vary from physical, biological, chemical, psychological, physiological, ergonomic and other risks to the health of pregnant women. Research in the United States in 2020 showed that pregnant women who work will potentially be exposed to air pollution and heat which are at risk of pregnancy disorders and complications such as premature birth, low birth weight, and stillbirth [17]

3.14. Place of residence

Mother's residence in rural areas increased the incidence of LBW more than mothers living in urban areas. This may be related to access to health services and availability of maternal needs during pregnancy. However, Bekkar et al. stated in their research that mothers who live in urban areas are more at risk of exposure to particulate matter, ozone and radiation so that they are more at risk of giving birth to premature babies, low baby weight and stillbirth [17]

3.15. History of adenomyosis

A history of adenomyosis was found to be one of the significant factors causing LBW. This is associated with previous maternal infertility. Not only adenomyosis but one condition that also affects infertility is endometriosis, endometriosis affects about 10% of women of reproductive age. Endometriosis is a chronic gynecological disease in which endometrial tissue that grows outside the uterus is affected by estrogen and causes inflammation, adhesions, and pain. The ovaries and Douglas cavum are most commonly affected by endometriosis [18]

3.16. Preeclampsia

Preeclampsia is a complication of pregnancy characterized by hypertension ($\geq 140/90$ mmHg) and proteinuria as a result of kidney damage. In pregnant women with preeclampsia, the blood supply to the fetus will be disrupted so that it will hamper fetal growth and development and risk fetal death.

4. Conclusion

In this systematic review study, there are maternal risk factors that play a significant role in the occurrence of LBW, including maternal age, parity, anemia, gestational age <37 weeks, and complications during pregnancy. The various risk factors identified indicate that the target of reducing LBW rates must take many approaches. The diversity of data available nationally is very useful for further research development. The various studies conducted on risk factors are

expected to help determine the distribution of causes as well as interventions for the handling and prevention of LBW. In the end, the author realizes that this article only reviews some of the risk factors for LBW, it is hoped that in the future there will be more studies that review more risk factors for LBW from various aspects and different methods.

Compliance with ethical standards

Disclosure of conflict of interest

We have no conflicts of interest to disclose.

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