



## Neonatal Low Birth Weight

Anargha Muraleedharan<sup>1</sup> Dr. Neethu J <sup>\*1</sup>

Dr. Lal Prashanth M L <sup>\*2</sup>

<sup>1</sup>: Student, 7th semester B Pharm

<sup>\*1</sup>: Professor, Dr. Moopen's college of pharmacy

<sup>\*2</sup>: Principal, Dr. Moopen's college of pharmacy

**Abstract** - Low birth weight (LBW) is a global public health issue affecting 30 million neonates, with developing nations accounting for 95%. It is linked to neurological impairment, developmental delays, academic dysfunction, and functional deterioration, making children six to ten times more prone to developing other diseases like cardiovascular and diabetes. The World Health Organization reports a 15% prevalence of LBW globally, with factors such as malnutrition, lack of healthcare, and adolescent motherhood contributing to the issue. South Asia has the highest prevalence, often exceeding 20%, due to factors like maternal undernutrition and socioeconomic challenges. LBW infants face significant short-term and long-term health outcomes, including increased mortality risks, developmental issues, respiratory issues, nutritional challenges, and jaundice. Strategies to address LBW include expanding healthcare coverage, improving nutritional support, supporting education, advocating for policies, and community-based interventions in low-resource settings.

**Index Terms** - Low birth weight, Epidemiology of low birth weight, Factors associated with LBW, Prevalence and distribution of LBW, Impact of LBW on Neonatal Health, Monitoring and early detection, Nutritional intervention, Maternal nutrition and LBW, Impact of socioeconomic factors on LBW, Intervention for LBW neonates in low resource setting, Community-based intervention, Quality and accessibility of healthcare facilities, Barriers to healthcare facilities, Antenatal care and LBW prevention, Health system strengthening, Identifying local solution, Improved maternal and neonatal care, Strengthening of the health system in a rural area

### Introduction

Birth weight, typically recorded within 1-4 hours, is crucial for infant mortality and morbidity. Low birth weight (LBW) is the primary cause, with 30 million neonates born globally, with developing nations accounting for 95%.

### Low birth weight

Birth weight (LBW) is a critical public health issue, increasing infant mortality rates and health challenges. LBW is linked to neurological impairment, developmental delays, academic dysfunction, and functional deterioration, making children six to ten times more prone to developing other diseases like cardiovascular and diabetes. It poses threats to a child's overall well-being.

## **Epidemiology of low birth weight**

The World Health Organization reports that low birth weight (LBW) is prevalent globally, with a 15% prevalence observed. Factors such as malnutrition, lack of healthcare, and adolescent motherhood contribute to LBW. While some areas are seeing a decrease in LBW babies due to improved healthcare and maternal nutrition, persistent social and economic inequalities persist. Women from low socio-economic backgrounds are at a higher risk of delivering LBW babies due to inadequate prenatal care, poor food quality, stress, and limited healthcare access. LBW impacts infant mortality and morbidity globally, particularly in developing countries.

### **Factors associated with LBW**

Low birth weight (LBW) can be attributed to environmental, psychological, fetal, and maternal factors.

#### **Maternal factors**

##### **a. Maternal health**

Maternal health significantly impacts the weight of babies born, with poor maternal health leading to pregnancy complications and a high likelihood of LBW. Risk factors include history of stillbirth, bleeding, placenta previa, thromboembolic disease, tuberculosis, malaria, periodontal disease, depression, hypertension, hypothyroidism, infertility, anemia, bleeding, antepartum hemorrhage, diabetes, infections, and underweight. Infections, such as bacterial vaginosis, STIs, and UTIs, cause intrauterine growth, resulting in LBW. Pregnancies with conditions like heart disease and malaria can also lead to IUGR and LBW, causing anemia and adverse pregnancy outcomes.

##### **b. Maternal age**

LBW is linked to teenage or older mothers, as they are still developing physically and can have complications during pregnancy. Factors such as being born before or at 37 weeks can also contribute to LBW.

##### **c. Maternal Lifestyle**

LBW is a condition where a baby's birth weight is significantly lower than expected due to factors such as smoking, heavy physical workload, heavy lifting, alcohol consumption, and caffeine intake.

##### **d. Maternal Socioeconomic Status**

Research indicates a correlation between socioeconomic status and the likelihood of underweight birth in children, affecting factors like education, employment, income, and medical care. Maternal literacy decreases the prevalence of LBW, as illiterate mothers may lack knowledge about healthy diets and their effects on the fetus.

##### **e. Maternal Nutrition**

Low birth weight (LBW) newborns are a result of malnutrition during pregnancy, affecting the mother's health and the newborn's development. Macronutrients, such as folic acid, are essential for the mother's health and the newborn's growth. Failing to take supplements increases the likelihood of abnormalities at birth in the unborn infant.

##### **f. Others**

LBW newborns are more likely to be delivered by mothers with familial vertical history, with shorter inter-pregnancy intervals, and stunted mothers are more likely to deliver low birth weights.

## **Fetal factors**

### **a. Neonatal jaundice**

LBW newborns often exhibit jaundice at birth, with clinically significant hyperbilirubinemia being prevalent in babies with extremely low birth weight (ELBW).

### **b. Intrauterine Growth Restriction (IUGR)**

IUGR occurs when a baby's fetal growth rate is below the expected rate, causing a low birth weight. This condition can be caused by various illnesses, such as diabetes, pre-eclampsia, chronic kidney disease, hypertension, or malnutrition. Placental abnormalities can also hinder growth, affecting the baby's ability to utilize oxygen and nutrients.

### **c. Congenital anomalies**

Congenital anomalies, such as heart, kidney, gastrointestinal, or skeletal diseases, can lead to low birth weight (LBW) in newborns. Structural-anatomic anomalies or pre-existing genetic conditions can increase the risk of LBW, causing intrauterine growth retardation and dysfunction in organs, metabolism, or nutrient absorption.

### **d. Multiple Gestation**

Multiple pregnancies, particularly twins, triples, or more, are strongly associated with low birth weight (LBW) due to the sharing of placentas and reduced exposure to nutrients. Teenage birth and preterm birth contribute to low birth weight. Placental insufficiency can affect one or more fetuses, deprived of necessary oxygen and nutrients. Discordant growth, where one or more babies develop larger than the other, can also affect the smaller fetus due to placental site variations.

### **e. Premature Birth (Preterm Birth)**

Preterm delivery is linked to low birth weight (LBW) as premature babies lack adequate time in their mother's womb to fully develop and mature, resulting in lower birth weight and less body fat and lean mass. Premature babies do not experience this fast-paced weight gain.

## **Environmental Factors**

### **a. Exposure to Environmental Toxins**

Environmental pollutants, such as pesticides, heavy metals, industrial chemicals, and volatile organic chemicals, can affect fetal growth and metabolism during pregnancy. These toxins can interfere with hormones, leading to low birth weight (LBW) babies. Endocrine disruptors, such as pesticides, phthalates, and BPA, can disrupt normal growth sequences, potentially resulting in LBW birth.

### **b. Air Pollution**

Pregnant women are highly susceptible to air pollution due to exposure to particulate matter, nitrogen dioxide, sulphur dioxide, and ozone from car exhaust, emission industries, and fossil fuel burning.

### **c. Water Contaminants**

Pregnant women exposed to contaminants like arsenic, nitrates, and chlorination in drinking water may be at risk for unborn babies, affecting fetal development and placental function

### **d. Occupational Exposures**

Pregnant women in industries with radiation, chemicals, or hazardous substances may be more susceptible due to the varied occupational exposures present in the workplace.

## e. Geographical Factors

Geography, industrial proximity, agricultural practices, and urbanization influence environmental contaminants exposure, increasing the risk for LBW and fetal development in women living in polluted areas.

## Psychosocial Factors

### a. Stress and anxiety

Stress and anxiety can harm a growing fetus, increasing the risk of low birth weight (LBW). Stress hormones like cortisol and adrenaline can impair fetal growth and oxygen access, while unhealthy habits can lead to LBW. Hormone disruptions can also cause premature labor and delivery. Stress and anxiety during pregnancy can increase the risk of low birth weight (LBW), impair fetal growth, cause premature labor, and worsen depression or insomnia symptoms. Long-term stress, poor maternal mental health, and past difficult pregnancies can also contribute.

### b. Social Support

Social support during pregnancy is crucial for a mother's health and birth outcomes, including low birth weight. It reduces anxiety, encourages healthy behaviors, and increases access to prenatal care, thereby influencing maternal mental health and pregnancy outcomes.

## Prevalence and distribution of LBW

### Global Prevalence

Low birth weight is prevalent globally, representing between 15% to 20% of all births. This indicates that one in every seven newborns globally is under the weight of 2,500 grams.

The prevalence of low birth weight (LBW) varies greatly throughout the world and is impacted by several variables, such as the mother's health, socioeconomic status, and access to health care.

Global rate: Roughly 15% to 20% of live births globally are categorized as low birth weight, meaning they weigh less than 2,500 grams or 5.5 pounds.

### Regional Prevalence:

South Asia has the highest prevalence of LBW, often exceeding 20%, due to factors like maternal undernutrition and socioeconomic challenges. East Asia and the Pacific have varying rates, with Southeast Asia showing higher rates. Sub-Saharan Africa has high prevalence, often above 15%, due to malnutrition and limited access to quality healthcare. Middle East and North Africa have moderate prevalence, while Latin America and the Caribbean have lower rates. Europe has low prevalence, with advanced healthcare systems and higher socioeconomic standards contributing to this.

## Impacts of lbw

Low birth weight, or LBW, has multiple significant impacts on the development of newborns that should be considered. The short-term and long-term health outcomes of LBW (Low Birth Weight) infants are significant and can have lasting implications throughout their lives:

### Short-term Health Outcomes:

Low birth weight (LBW) babies face increased mortality risks due to their undeveloped immune systems and immature organs. They may also have developmental issues, respiratory issues, nutritional challenges, and difficulty regulating body temperature. Additionally, they may experience jaundice, which can worsen their condition if left untreated. LBW infants are also more prone to infections, potentially leading to severe complications like sepsis.

## **Long-term Health Outcomes:**

Lower birth weight (LBW) infants are more susceptible to neurological conditions, cognitive delays, chronic health conditions, behavioral issues, and educational difficulties. They may experience ADHD, anxiety, and depression, and may struggle with educational attainment and career goals. Social and emotional challenges, such as long hospital stays and medical procedures, can affect newborns' bonding with caregivers. Financial and emotional burdens can also arise due to long-term developmental assistance and extended hospital stays.

## **Monitoring and early detection**

Low Birth Weight (LBW) is a condition that requires early detection and management. Key strategies include regular prenatal care, measuring fundal height, performing ultrasounds, and assessing fetal growth. Ultrasound evaluations, particularly in the third trimester, provide detailed measurements of fetal growth. Fetal Doppler studies assess blood flow in the umbilical artery, and biomarkers in maternal blood can provide insights into fetal development. Risk factors such as inadequate nutrition, maternal age, socioeconomic status, and previous obstetric history are essential for early detection. Accurate gestational age assessment is crucial for interpreting fetal growth parameters. Educating expectant mothers about prenatal care, nutrition, and medical recommendations can optimize fetal growth and reduce LBW risk. Collaborative care among obstetricians, maternal-fetal medicine specialists, nurses, midwives, and nutritionists facilitates comprehensive monitoring and early intervention strategies.

## **Nutritional intervention**

Nutritional interventions are crucial for low-weight (LBW) infants to promote healthy growth and development. Key interventions include exclusive breastfeeding, Kangaroo Mother Care, fortified breast milk, preterm formulas, vitamin and mineral supplements, frequent feeding, parenteral nutrition, gradual introduction of solid foods, education and support for caregivers, regular medical follow-ups, and addressing underlying conditions.

Breastfeeding is recommended for the first six months, while preterm formulas are designed for infants who cannot be breastfed. Vitamin D, iron, zinc, calcium, and phosphorus supplementation may be necessary for bone health. Frequent feeding and monitoring of growth are essential for LBW infants. Parenteral nutrition may be necessary for extremely LBW infants who cannot tolerate enteral feeding. Regular medical follow-ups are essential for monitoring growth and adjusting nutritional plans.

## **Psycho-social impact**

Low birth weight infants have a significant psycho-social impact on parents, caregivers, and the family. Parents may experience anxiety, stress, depression, and PTSD due to uncertainty about the infant's health and future development. The social impact can strain marital relationships and cause financial stress. LBW infants are at higher risk for developmental delays, behavioral issues, and chronic health issues. Support systems for parents can help mitigate this impact.

## **Maternal nutrition and LBW**

Maternal nutrition is crucial for determining an infant's birth weight, and inadequate nutrition is a risk factor for low birth weight (LBW). A healthy BMI before conception is essential for reducing LBW risk. Insufficient intake of protein, carbohydrates, fats, iron, folic acid, calcium, zinc, and vitamins can contribute to poor pregnancy outcomes. Maternal malnutrition and LBW are linked to undernutrition, micronutrient deficiencies, and health conditions.

## **Maternal health behaviour and LBW**

Maternal health behavior during pregnancy significantly impacts the risk of low birth weight (LBW) in infants. Lifestyle choices, adherence to medical advice, substance use, and overall health management are key factors. Poor dietary habits, inadequate supplementation, and stress can lead to fetal alcohol spectrum disorders (FASD). Regular prenatal care, vaccinations, and managing chronic conditions are essential.

Cultural practices and beliefs, particularly those related to diet and healthcare, can also influence maternal behaviors.

### **Impact of socioeconomic factors on LBW**

Socioeconomic factors significantly impact the risk of low birth weight (LBW), affecting maternal health behaviors, access to healthcare, nutrition, and living conditions. Key factors include income, job stress, work environment, housing, health insurance, and access to social services. Low-income individuals may have limited access to prenatal care, leading to malnutrition. Education levels and employment opportunities also impact health literacy. Social support networks can positively influence maternal health behaviors and reduce stress. Strategies to address LBW include expanding healthcare coverage, improving nutritional support, supporting education, and advocating for policies that improve healthcare access.

### **Intervention for LBW neonates in low resource setting**

Low birth weight neonates in low-resource settings require effective interventions like Kangaroo Mother Care (KMC), exclusive breastfeeding, thermal care, infection prevention, nutritional support, parenteral nutrition, monitoring, community-based health services, maternal health education, referral systems, addressing socioeconomic factors, advocacy and policy development, and cost-effective solutions. These interventions provide warmth, breastfeeding support, thermal care, infection prevention, nutritional support, monitoring, follow-up, community-based health services, maternal health education, family planning, and addressing socioeconomic factors.

### **Community-based intervention**

Community-based interventions are crucial in addressing low birth weight (LBW) in areas with limited healthcare resources. These strategies include maternal education, nutritional support programs, kitchen gardens, Kangaroo Mother Care training, mobile clinics, home visits, and community health centers. Mental health services, counseling, and birth preparedness plans are also provided. Community engagement, advocacy, and health surveillance are essential for early identification of at-risk pregnancies. Collaboration with NGOs and government programs ensures sustainability and consistency.

### **Quality and accessibility of healthcare facilities**

Healthcare facilities are crucial for the survival and long-term outcomes of low birth weight neonates. Factors affecting these include specialized care, skilled providers, standardized protocols, infection control, hygiene, essential medications, and geographic accessibility. High-quality facilities should have well-equipped NICUs, trained healthcare providers, and multidisciplinary teams. Accessibility can be improved by proximity, reliable transportation, financial assistance, and cultural sensitivity. Education programs, continuity of care, and community health workers can also enhance accessibility.

### **Barriers of health care facilities**

Addressing low birth weight cases requires overcoming various barriers in healthcare facilities. These include inadequate infrastructure, financial constraints, geographical and accessibility barriers, cultural and social barriers, systemic and policy-related barriers, and technological barriers. Overcoming these challenges is crucial for providing quality care, ensuring the survival and long-term health outcomes of LBW neonates, and improving their overall health outcomes.

## Antenatal care and LBW prevention

Antenatal care (ANC) is crucial in preventing low birth weight (LBW) by identifying and managing risk factors. Key aspects include early visits, nutritional support, balanced diet education, health education, behavior change, medical screening, monitoring maternal health, socioeconomic factors, psychosocial support, and preparation for safe delivery. ANC helps identify high-risk pregnancies, monitor fetal growth, provide nutritional support, promote health education, encourage physical activity, and provide medical screening. Skilled birth attendants are encouraged during ANC visits.

## Health system strengthening

Strengthening health systems in rural areas is crucial for improving maternal and neonatal health outcomes. Key strategies include expanding healthcare infrastructure, enhancing workforce capacity, integrating community-based interventions, improving supply chain management, leveraging technology, and addressing socioeconomic determinants of health.

1. Expanding healthcare infrastructure: Establishing rural health centers and mobile health clinics can provide basic maternal and neonatal care closer to people's homes.
2. Strengthening referral systems: Developing efficient referral networks and transportation solutions can ensure timely specialized care for LBW cases.
3. Enhancing workforce capacity through training and education of healthcare providers, such as neonatal resuscitation, infection control, and Kangaroo Mother Care (KMC).
4. Recruitment and retention of healthcare workers through incentives and peer support networks.
5. Integrating community-based interventions: Training community health workers (CHWs) to provide antenatal care, educate mothers on nutrition, and monitor the health of LBW infants can extend healthcare services into rural communities.
6. Community engagement and education: Health education campaigns and involvement of local leaders can increase awareness and promote health-seeking behavior.
7. Improving supply chain management: Ensuring the availability of essential supplies, collaborating with NGOs, and encouraging local production and procurement can improve availability in rural areas.
8. Leveraging technology: Telemedicine and e-health solutions, such as remote consultations and digital health records, can improve continuity of care for pregnant women and LBW infants.
9. Addressing socioeconomic determinants of health: Integrating agricultural programs that improve food security with health interventions, providing nutritional support programs, and advocating for cash transfer programs can improve maternal and neonatal health outcomes.

## Identifying local solution

Local solutions for low birth weight (LBW) involve utilizing community resources, traditional knowledge, and local innovations. Strategies include training Community Health Workers, promoting local nutritional solutions, strengthening community-based support systems, developing health education programs, improving access to health services, harnessing local innovations, promoting social and economic support, engaging local leadership, and monitoring and evaluating solutions. Traditional knowledge, cultural sensitivity, and community-based support systems can enhance healthcare programs' effectiveness. Local health education programs and innovations can address micronutrient deficiencies and provide financial stability.

## Improved maternal and neonatal care

Strategies include optimizing antenatal care, enhancing intrapartum care, providing nutritional support, and implementing local food fortification programs. Skilled birth attendants and immediate neonatal care are also crucial. Strengthening healthcare systems, addressing socioeconomic determinants, and monitoring and evaluating healthcare quality are also essential.

## Strengthening of health system in rural areas

The health system in rural areas is being strengthened to control low birth weight (LBW) by addressing unique challenges and implementing targeted strategies. Key strategies include improving healthcare infrastructure, training healthcare workers, strengthening community-based interventions, improving access to services, and strengthening health information systems. Health facilities should be upgraded, referral networks established, mobile health services deployed, professional training provided, and retention of healthcare professionals. Policy development should integrate maternal and neonatal care with other health services.

## Conclusion

Low birth weight (LBW) is a significant public health issue affecting 30 million neonates globally, with developing nations accounting for 95%. It is linked to neurological impairment, developmental delays, academic dysfunction, and functional deterioration, making children six to ten times more prone to developing other diseases like cardiovascular and diabetes. Factors such as malnutrition, lack of healthcare, and adolescent motherhood contribute to LBW. Maternal factors include maternal health, age, lifestyle, socioeconomic status, nutrition, and others. Environmental toxins, air pollution, water contaminants, occupational exposures, and geographical factors also contribute to LBW.

Socioeconomic factors significantly influence the risk of LBW, affecting maternal health behaviors, access to healthcare, nutrition, and living conditions. Key socioeconomic factors include income level, job stress, work environment, housing and living conditions, health insurance, and access to social services. Low-income individuals may have limited access to prenatal care, leading to undiagnosed or poorly managed health conditions. Nutritional constraints can limit access to nutritious foods, causing maternal malnutrition. Education levels also impact health literacy, leading to unhealthy behaviors and delayed prenatal care.

Limited access to healthcare facilities and providers in low-income or rural areas can also limit access to necessary care. Social support networks, such as family and community support, can positively influence maternal health behaviors and reduce stress. Strategies to address the impact of socioeconomic factors on LBW include expanding healthcare coverage, establishing mobile and community clinics, improving nutritional support, supporting education and health literacy, developing targeted interventions, strengthening social support networks, addressing racial and ethnic disparities, and advocating for policies that address structural inequalities and improve access to quality healthcare.

Antenatal care (ANC) is crucial in preventing LBW, defined as a birth weight of less than 2,500 grams (5.5 pounds). Key aspects of ANC include early and regular visits, nutritional support, balanced diet education, health education, behavior change, medical screening, monitoring and managing maternal health, socioeconomic factors, psychosocial support, and preparation for safe delivery. Strengthening health systems in rural areas is essential for improving maternal and neonatal health outcomes.

Local solutions for LBW involve utilizing community resources, traditional knowledge, and innovations. Strategies include engaging CHWs, promoting nutritional solutions, strengthening support systems, and improving access to health services. Improving maternal and neonatal care is crucial for controlling LBW. Strengthening healthcare systems includes expanding access and improving infrastructure.

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