Optimal Feeding of Low-Birthweight Infants in Low- and Middle-Income Countries

Highlights from the World Health Organization 2011 Guidelines

June 2017 www.mcsprogram.org

Key Messages

- Over 20 million low-birthweight infants are born each year, of which over 90% are in the developing world. Low birthweight is a consequence of preterm birth, small for gestational age, or a combination of both. Low-birthweight infants are at increased risk for morbidities and mortality, developmental delays, long-term neurological sequelae, and chronic medical problems.
- To decrease morbidity and mortality of low-birthweight infants, care and support of their feeding needs must be provided with high quality.
- Optimal feeding practices for low-birthweight infants include early initiation of breastfeeding when possible, breast milk feeding through other means until breastfeeding is possible, exclusive breastfeeding until 6 months of age, and continued breastfeeding up to 2 years and beyond. These represent critical pieces for ensuring responsive care and healthy growth and development of low-birthweight infants, but they often require additional support for mothers and families to achieve, particularly in the first days after birth.
- Aligning country policies and programs with updated guidelines and recommendations is necessary to ensure optimal feeding

Background

Over 20 million low-birthweight (LBW) infants are born each year, with over 90% of these in developing countries. Low birthweight can be a consequence of preterm birth (defined as birth before 37 completed weeks of gestation), small size for gestational age (defined as weight for gestation below the 10th percentile), or both. LBW infants are at higher risk of neonatal hypothermia, hypoglycaemia, sepsis, and newborn death. They are also at higher risk for long-term effects, such as cerebral palsy, learning impairments and developmental delays, visual and hearing disorders, and for noncommunicable diseases later in life, such as diabetes and cardiovascular disease.[1] Low birthweight is a significant contributor to under-5 mortality.

Definitions

- **Low birthweight:** birth weight below 2,500 g
- **Very low birthweight:** birth weight below 1,500 g
- **Extremely low birthweight:** birth weight below 1,000 g
- **Small for gestational age:** weight for gestational age below 10th percentile
- **Intrauterine growth restriction:** slower-than-normal velocity of fetal growth
- **Preterm birth:** born before 37 completed weeks of gestation

Newborn and infant mortality rates can be reduced by providing appropriate care to LBW infants, including temperature maintenance; optimal feeding; cord and skin care; and prevention, early detection, and treatment of infections. In the 1960s[2] in the United Kingdom, better feeding was one of the first interventions for preterm babies associated with reduced hospital mortality even before intensive care was available.

The World Health Organization (WHO) has reviewed the scientific evidence and developed guidelines for the optimal feeding of LBW and very LBW (VLBW, below 1,500 g at birth) infants in low- and middle-income countries (LMIC). Details of the systematic reviews of the scientific literature and full recommendations are available in *WHO Guidelines on Optimal Feeding of Low Birth-Weight Infants in Low- and Middle-Income Countries* (2011).

[1] Blencowe H et al. 2013. Born too soon: the global epidemiology of 15 million preterm births. *Reproductive Health.* 10(Suppl 1): S2. doi: 10.1186/1742-4755-10-S1-S2.
[2] Fryer JG, Ashford JR. 1972. Trends in perinatal and neonatal mortality in England and Wales 1960–69. *British Journal of Preventive and Social Medicine.* 26(1):1–9.

The guidelines do not specifically address the needs of extremely LBW (less than 1,000 g) infants, who represent only a small proportion of LBW infants and are often clinically unstable. Guidance on the management of clinically unstable infants is available in other WHO documents.[3]

Information in this brief should be complemented by other important documents on interventions for LBW infants. Kangaroo mother care (KMC), which includes a package of early and continuous skin-to-skin contact, breastfeeding support, timely discharge, and postdischarge follow-up has been shown to reduce newborn mortality in LMIC and is currently recommended for LBW infants weighing less than 2 kg. Prevention of infection by handwashing is key to reduce mortality and morbidity due to infection both in health facilities and at home. Recommended feeding practices for HIV-exposed infants, which includes support for safe breastfeeding and appropriate use of antiretroviral medications for mother and infant, reduces the risk of HIV transmission through breast milk.

This brief presents the updated WHO recommendations, and highlights changes and best practices for optimal feeding of LBW infants. It is intended to assist policymakers, program managers, educators, and health care providers involved in caring for LBW infants to put the recommendations into action. It is hoped that such actions will contribute to improving the quality of care for LBW infants, thereby reducing LBW mortality and improving health outcomes for this group.

Table 1. Recommended practices for optimal feeding of LBW infants and their rationale

Recommendation (WHO 2011)	Rationale
What to Feed	
Choice of Milk	
1. Low-birthweight (LBW) infants, including those with very low birthweight, should be fed their **own mother's milk**.	Breast milk-fed babies have lower mortality and lower incidence of infections and necrotizing enterocolitis (NEC) than those fed with infant formula.
2. LBW and very low-birthweight (VLBW) infants who cannot be fed their own mother's milk should be fed donor human milk.	Feeding heat-treated donor human milk to LBW infants is associated with lower incidence of infections and NEC during the initial hospital stay after birth compared with infant formula. Note: Heat-treated donor milk should be used only if recommended safety standards are met.
3. LBW and VLBW infants who cannot be fed their own mother's milk or donor human milk should be fed **standard** infant formula. Subsequently, if VLBW infants fail to gain weight despite adequate feeding with standard infant formula, preterm infant formula should be tried.	Preterm formula has benefits for short-term growth as compared to standard infant formula, but there is no significant benefit to mortality, neurodevelopment, and long-term growth. Given the lack of long-term benefits and the higher cost of preterm formula, there is no justification for its use in low- and middle-income countries (LMIC). *Note: Infant formula should always be prepared observing strict hygienic standards.*
4. LBW infants, including VLBW infants, who cannot be fed their mother's own milk or donor human milk should be fed standard infant formula from the time of discharge until 6 months of age.	Nutrient-enriched infant formula has no significant effect on neurodevelopment or anthropometric status at 12 to 18 months of age and is costly as compared to the standard formula. The observed lack of benefits does not justify the costs in LMIC. *Note: Infant formula should always be prepared observing strict hygienic standards.*
5. VLBW infants who are fed own mother's milk or donor human milk should **not** routinely be given cow's milk-based human milk fortifier. VLBW infants who fail to gain weight despite adequate breastmilk feeding should be given human milk fortifiers, preferably those that are human milk based.	There was no evidence of significant benefit or harm associated, even with feeding fortified human milk. The only benefit observed was in short-term growth during initial hospital stay, so it should be given only to those who fail to gain weight despite adequate breast milk feeding. Human milk-based fortifiers are associated with lower risk of NEC as compared to cow's milk-based fortifiers.
Supplements	
6. VLBW infants should be given vitamin D supplements at a dose ranging from 400 IU to 1,000 IU per day until 6 months of age.	Giving higher doses of vitamin D (more than one recommended dietary allowance) in preterm babies does not have any added advantage in terms of anthropometric status or bone mineralization. They should be given the same dose as term newborn babies.

[3] World Health Organization. 2013. *Pocket Book of Hospital Care for Children: Guidelines for the Management of Common Illnesses with Limited Resources.*

Recommendation (WHO 2011)	Rationale
7. VLBW infants who are fed their mother's own milk or donor human milk should be given daily calcium (120–140 mg/kg per day) and phosphorus (60–90 mg/kg per day) supplementation during the first months of life.	Giving daily calcium and phosphorus supplements has some benefit in reducing metabolic bone disease in preterm VLBW infants and has low associated cost, making it a recommended intervention.
8. VLBW infants fed their own mother's milk or donor human milk should be given 2–4 mg/kg per day iron supplementation starting at 2 weeks until 6 months of age.	Early iron supplementation starting at 2 weeks of life reduces the risk of severe anaemia and need for blood transfusion in VLBW infants.
9. Daily oral vitamin A supplementation for LBW infants who are fed their own mother's milk or donor human milk is **not** recommended.	Daily oral vitamin A supplementation was not found to be associated with any benefit or harm and has additional cost involved, so it is not recommended in VLBW infants because there is not enough evidence of benefit to support such a recommendation.
10. Routine zinc supplementation for LBW infants who are fed their own mother's milk or donor human milk is **not** recommended.	Daily oral zinc supplementation was not found to be associated with any benefit or harm and has additional cost involved, so it is not recommended in LBW infants because there is not enough evidence of benefits.
When and How to Initiate Feeding	
11. LBW infants should be put to the breast as soon as possible after birth when they are clinically stable, as many will be able to breastfeed.	Initiation of breastfeeding in the first day of life is associated with a significant reduction in the risk of newborn mortality when compared with delaying breastfeeding for more than 24 hours after birth. This recommendation is consistent with the recommendation for the general population of newborns to initiate breastfeeding as soon as possible within the first hour after birth. Newborns should be placed skin to skin as soon as their breathing is stable, and the mother should be supported for positioning and attachment. If the newborn is unable to attach to the breast, the mother can express directly into the newborn's mouth, eventually transitioning to full breastfeeding as the newborn matures.
12. VLBW infants weighing more than 1 kg should be given 10 ml/kg per day of enteral feeds, preferably expressed breast milk, starting from the first day of life, with the remaining fluid requirement met by intravenous fluids.	Initiating small volumes of oral feeds in the first few days of life, along with parenteral nutrition, improves mucosal immunity and increases the secretion of gut hormones and enzymes. Preferably own mother's breast milk whenever possible.
Optimal Duration of Exclusive Breastfeeding	
13. All infants including, LBW and VLBW infants, should be exclusively breastfed until 6 months of age.	As laid out in the Global Strategy for Infant and Young Child Feeding,[4] the cost of substituting breast milk with formula milk—in terms of financial costs, long-term health effects, and risks of contamination involved in formula milk preparation in LMIC—are major reasons to favour exclusive breastfeeding until 6 months.
How to Feed	
14. For LBW infants who are unable to attach at the breast, promote skin-to-skin contact and continued feeding with expressed breast milk (with the appropriate alternative feeding method, i.e., cup, spoon, or palladai).	Cup feeding facilitates exclusive breastfeeding rates at discharge and decreases episodes of apnoea and desaturation during feeding. Cups and spoons are also easier to keep clean compared to bottles and teats, thereby reducing the risk of infection in LMIC. Also, long-term sequelae, including asthma, mal occlusions, and acute otitis media, in those under 2 are reduced.[5]
15. VLBW infants requiring intragastric tube feeding should be given bolus intermittent feeds (versus continuous feeding).	Neither of the feeding methods was associated with any benefit or harm. Bolus or intermittent feeding is recommended due to its lower cost, in terms of not needing unnecessary equipment.

[4] World Health Organization. 2003. *Global Strategy for Infant and Young Child Feeding.*
[5] Impact of breastfeeding on maternal and child health. 2015. Special issue, *Acta Paediatrica.* 104(S467).

Recommendation (WHO 2011)	Rationale
16. In VLBW infants who need to be given intragastric tube feeding, the intragastric tube may be placed either by oral or nasal route, depending upon the preferences of health care providers.	There is no evidence for benefits or harms in any of the critical outcomes with either route of placement of the feeding tube. Orogastric tubes are more difficult to fix, resulting in frequent change, thus increasing the costs. On the other hand, the nasogastric tube has been associated with some deterioration in physiological parameters, such as airway resistance, and carries a risk of injury to the nasal mucosa.
How Frequently to Feed and How to Increase the Daily Feed Volumes	
17. LBW infants who are fully or mostly fed by an alternative oral feeding method should be fed based on infants' hunger cues, except when the infant remains asleep longer than three hours since the last feed.	Feeding based on infants' hunger cues reduces the time to reach full enteral feeds and possibly the length of hospital stay. It should be noted that this requires well-trained health providers to support mothers.
18. In VLBW infants who need to be fed by an alternative oral feeding method or given intragastric tube feeds, feed volumes can be increased by up to 30 ml/kg per day with careful monitoring for feed intolerance.	The volume of the feeds given to LBW infants can be increased by a maximum of 30 ml/kg per day until full feeds (150–180 ml/kg per day) are reached in the first week of life.

How Can Countries Achieve Best Practices for Feeding LBW Infants?

Table 2. Implementation considerations

Policy and Programme Changes
• Align: Ensure national policies and plans on care of preterm and LBW infants are aligned with the recommendations for optimal feeding for LBW infants. • Adapt: Ensure local guidelines, clinical care standards, and protocols on optimal feeding of LBW and VLBW infants for each level of care are adapted to be in line with the new recommendations, and are available in all health facilities for care during hospitalization and after discharge. • Promote comprehensive care: Establish linkages between LBW feeding policies and other maternal and newborn health (MNH) interventions to prevent and manage LBW and premature birth to improve infant survival, growth, and development. Comprehensive MNH care may include nutritional counselling before and during pregnancy to improve maternal nutritional status and support mothers to prepare for good infant feeding practices, management of preterm labour, and ensuring essential newborn care for preterm babies, including KMC, and follow-up of mother and baby in the postnatal period. • Provide capacity-building: Ensure inclusion of the new recommendations within quality improvement tools, and pre-service and in-service training curricula. • Data collection and monitoring: Ensure routine collection and use of data for monitoring the implementation of the recommendations. During hospitalization, use individual patient records for monitoring daily feeding of LBW and VLBW infants and their growth using standardized growth charts; assess feeding, growth, and multinutrient deficiencies in follow-up visits after discharge to identify and solve early problems. • Partnership: Work with and empower parents, parents' groups, and developmental partners in-country to ensure consistent messages on adequate feeding for LBW infants are provided to providers and mothers/families.
Health Worker Skills and Competencies
• Update facility-based health workers' skills and competencies for optimal feeding of LBW and VLBW infants to protect, promote, and support best practices according to the new recommendations to – Ensure all infants are placed skin to skin as soon as clinically stable and fed colostrum as soon as possible after birth. – For babies who are younger than 34 weeks of gestation and able to only breastfeed for a short duration, teach and support mothers to express and store breast milk in a safe and hygienic way starting as soon after birth as possible and every three hours to establish milk production, and to feed it to the baby by other feeding methods (i.e., cup or spoon feeding, orogastric tube). – Safely and correctly use intragastric feeding, if indicated. – When babies can coordinate sucking, swallowing, and respiration (usually around 33–34 weeks of gestation), they should gradually be started on breastfeeding before feeding by orogastric tube or cup. Transition should be based on an infant's developing capability. For babies fed by orogastric tube or cup, put the baby to the breast at each feed, allowing the baby to smell and lick the milk, subsequently progressing to full breastfeeding. Until then, complete the rest of the feed by orogastric tube or cup. – Support mothers to breastfeed the baby by helping them to position the baby well for a good attachment, and to prevent and resolve any breastfeeding difficulties (e.g., cracked nipples).

- Support other carers, including family members, to safely feed the baby if the mother is unable to do so.
- Use appropriate alternative feeding methods if breast milk from the newborn's own mother is unavailable (preferably heat-treated donor human milk, or possibly infant formula, in this order of preference).
- Discharge a baby when it has gained weight for three days on breast milk alone, there are no other problems, and the mother is confident and comfortable in taking care of and handling the baby.
- Support mothers to maintain exclusive breastfeeding until the baby reaches 6 months of age and to continue breastfeeding until 2 years of age (with appropriate other adequate and safe complementary feeding).

- Ensure supervision and mentoring of health workers to provide optimal feeding of LBW and VLBW infants.

Commodities

- Ensure availability and maintenance of essential equipment for optimal feeding of LBW and VLBW infants, including:
  - Suitable weighing scales to monitor weight gain of 10 g
  - Teaching mothers to express and safely store their own breast milk (clean cups with lids and storage facilities, such as refrigerators)
  - Cups and spoons, or cups with a beak, to feed infants who are unable to breastfeed directly
  - Supplies of intragastric gastric tubes, marker pens, syringes, tapes, and stethoscopes to measure, mark, insert, fix, and check correct positioning of feeding tubes in infants by trained health workers
  - Supplies for intravenous fluid delivery to VLBW infants
  - Supplies for expressing, storing and pasteurising donated breast milk
  - Supplies of standard infant formula (for babies who cannot be breastmilk fed)
  - Micronutrient supplements and human milk fortifiers[6] for VLBW infants
  - Charts for documentation of feeding method, volumes, and weight gain
- Review if additional infrastructure and staff are required at each level of care (milk storage facilities, pasteurizers, laboratory testing facilities) to provide optimal feeding of LBW and VLBW infants.

Community Actions

- Promote increased family and community awareness of the importance and benefits of exclusively breastfeeding LBW and VLBW babies during hospital stay and after discharge, its potential to promote adequate growth and development, and its potential to prevent infections and death.
- Promote increased family and community awareness on the risks of formula feeding and of early introduction of other feeding products.
- Promote increased family and community awareness of the need for regular follow-up of LBW infants after discharge to monitor their growth and development, and for early detection and treatment of complications.

Table 3. Recommended indicators for monitoring LBW feeding policy and program implementation

Input Indicators

- The health facility has written, up-to-date, clinical protocols for care of small and preterm babies in the childbirth and postnatal areas of the maternity unit and paediatric ward that are consistent with WHO guidelines.
- The health facility has supplies and materials to provide optimal thermal care to stable preterm babies using KMC (wrappers/support binders, baby hats, and socks), functional and clean incubators, or radiant warmers.
- The health facility has supplies and materials to provide optimal feeding to preterm babies and support for breastfeeding or alternative feeding (feeding cups and spoons, infant formula, milk storage facilities, pasteurizers, a milk bank if possible, nasogastric tubes, IV fluids, syringe pumps).
- Health care facility staff who work with pregnant and postpartum women and newborns receive in-service training and regular refresher sessions at least once every 12 months in appropriate care for preterm and LBW babies to ensure they are competent to help mothers to breastfeed their infants.

Output Indicators

- The percentage of LBW newborns born in the health facility who were breastfed within one hour of birth
- The proportion of LBW newborns born in the health facility whose mothers received additional support to establish breastfeeding
- The proportion of all LBW newborns born in the health facility who were exclusively fed on their mother's own milk (by any feeding method) during the stay in the health facility
- The proportion of LBW babies who could not be breastfed and were fed by a cup, spoon, or cup with a beak during the hospital stay
- The proportion of all newborns born in the health facility with a birthweight equal to or less than 2,000 g at birth who received KMC in the first week of life
- The proportion of infants exclusively breastfed up to 6 months of age

[6] Fortifiers are intended for hospital-based use, preferably in infants weighing less than 1,500 g. Human milk fortifiers are not always well tolerated and are extremely expensive. Careful consideration should be taken when planning for fortifier use in resource-limited settings.

Additional References

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This brief is made possible by the generous support of the American people through the United States Agency for International Development (USAID) under the terms of the Cooperative Agreement AID-OAA-A-14-00028.

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