

Management of low birth weight (LBW) babies

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Introduction

The normal birth weight of newborns in our country is around 2800 to 3000 gm. Low birth weight or LBW, as it is abbreviated, denotes birth weight of less than 2500 gm. In India, about 30 percent infants born are LBW.

Nearly 75 percent neonatal deaths and 50 percent infant deaths occur among the low birth weight neonates. Even after recovering from neonatal complications, some LBW babies may remain more prone to malnutrition, recurrent infections, and neurodevelopmental handicaps. Low birth weight, therefore, is a key risk factor of adverse outcome in early life.

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Types of LBW

The newborn baby can be LBW because of two reasons. First, the baby may be *preterm or premature*. A preterm baby has not yet completed 37 weeks of gestation. Since fetal size and weight are directly linked to gestation, it is obvious that if the delivery takes place prematurely, the baby is likely to have less weight. The second situation that leads to low birth weight is *intrauterine growth restriction or IUGR*. This condition is similar to malnutrition. Here, gestation may be full term or preterm, but the baby is undernourished, undersized and therefore, low birth weight. Such a baby is also called *a small-for-date or SFD neonate*. Two thirds of our LBW neonates fall in this category. At times, a LBW neonate may be both *preterm* as well as *small-for-date*.

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Etiology of LBW

Preterm labour occurs in teenage mothers and in the setting of low maternal weight, cervical incompetence, antepartum hemorrhage, previous fetal loss, previous preterm delivery. Sometimes, preterm labor is medically induced for the sake of the baby as in the case of Rh isoimmunisation or maternal diabetes mellitus. The cause of a majority of preterm deliveries, however, remains unknown.

Poor nutritional status of the mother and frequent pregnancies are the major causes of intrauterine growth retardation. Mothers with a weight of less than 40 kg and a height of less than 145 cm often give birth to small-for-date babies. Insufficient nutritional intake during pregnancy also has an adverse effect on fetal weight. Maternal hypertension, pre-eclampsia, post-maturity, frequent pregnancies, multiple pregnancy, anemia, malaria and tobacco use are other causes of intrauterine growth retardation. Chronic maternal diseases of heart, kidneys, lungs or liver may also lead to intrauterine growth retardation.

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Recognizing preterm and SFD infants

It is desirable and of practical relevance to make clinical distinction between the two types of LBW babies. Preterm baby is diagnosed on the basis of period of gestation calculated from the last menstrual cycle of the mother. If it is less than 37 completed weeks, the baby in question is preterm. Preterm babies also have distinct physical features which help in their recognition. If you examine their soles, you notice that the deep skin creases on them are present only on the anterior one third. The external ear or the pinna is soft and devoid of cartilage. Hence, it does not recoil back promptly on being folded. In males, the scrotum does not have rugae and testes are not descended into the scrotum. In females infants, the labia are widely separated, not covering the labia minora, resulting in the prominent appearance of the clitoris. The back of the preterm babies has abundant growth of fine hair called lanugo.

Small-for-dates neonates have an emaciated look and loose folds of skin because of lack of subcutaneous tissue. These are particularly prominent over the buttocks

and the thighs. They look alert and often plethoric. If you compare the head circumference with chest circumference, it is easy to identify a small-for-dates baby. Normally, the head is bigger than the chest by about 2 cm. In small-for-date babies, the head circumference exceeds the chest circumference by more than 3 cm. The small-for-date babies are often full term or borderline term in gestation. When their birth weight is plotted on the intrauterine growth chart, it falls below the 10th centile. Any baby at birth may be classified based on gestation into preterm, term or postterm and on the birth weight into small-for-dates (SFD) appropriate-for-dates (AFD), and large-for-dates (LFD).(see intrauterine growth chart).

Remember that if a baby is preterm as well as small-for-dates, he/she would have a combination of the above mentioned features.

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Problems of preterm neonates

The LBW babies are predisposed to a number of neonatal problems. These are somewhat different in the preterm and the small-for-dates infants. Let us first look at the problems of the preterm babies.

The basic underlying feature of the preterm LBW infant is immaturity of their organ systems. They may not establish respiration satisfactorily at birth and develop asphyxia necessitating expert resuscitation. Newborn babies keep themselves warm by active metabolism in the brown fat stores. The preterm babies lack brown fat and therefore become hypothermic at the usual ambient temperature unless specific measures are taken to keep them warm. Preterm neonates less than 34 weeks of gestation cannot coordinate sucking and swallowing. Therefore, they are unable to feed from the breast. Preterm LBW infants, especially those less than 30 weeks of gestation may not tolerate any enteral feeds initially because of gut immaturity. Preterm babies especially those less than 34 weeks have immature lungs which do not expand well after birth and are therefore unable to perform the function of gas exchange. They develop respiratory distress syndrome characterised by rapid and labored respiration, indrawing of the chest, grunting, and cyanosis. Because of the immature respiratory control mechanisms these babies also have a tendency for apneic spells. In an apneic spell the baby stops

breathing, develops slow heart rate and turns blue. Preterm infants also have immature vascular bed around the brain ventricles. These delicate vessels may rupture and cause intraventricular hemorrhage. Immature metabolic pathways of preterm infants predispose them to develop hypoglycemia, metabolic acidosis and hyperbilirubinemia. Infection is another major problem among preterm babies and indeed an important killer because they are immunocompromised hosts. These babies do not have efficient humoral, cellular and mucosal immune mechanisms to protect themselves against bacteria. Besides, interventions such as needle pricks and intravenous lines, especially in the setting of a contaminated environment, predispose them to potentially fatal bacterial infections. Preterm infants given excess oxygen may develop blindness because of damage to the immature retina, a condition called Retinopathy of Prematurity.

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Problems of SFD neonates

The neonatal complications in the small-for-date babies are slightly different. The basic underlying problem among them is in-utero undernutrition and hypoxia. They have small placentae. The stress of labor may lead to fetal distress, meconium passage in utero and birth asphyxia. Since, they are chronically undernourished in utero, they also lack adequate brown fat stores. This predisposes them to hypothermia. They also develop hypoglycemia because of insufficient energy stores. They too are candidates for neonatal sepsis because of the ill effects of chronic intrauterine stress on the immune system. Small-for-dates infants are more likely to have malformations than their normal counterparts. They also face feeding difficulties, though to a lesser extent than the preterm babies.

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Management: Issues at birth

Ideally, the delivery of an anticipated LBW baby should be conducted in a hospital. Premature labor as well as intrauterine growth restriction are indications for referral of the pregnant mother to a well-equipped facility. This in-utero transfer of a low weight *fetus* is far more desirable, convenient and safe than the transport of a low weight *baby* afterbirth. Delivery should be conducted by trained health

professionals, of whom, at least one should be well-versed with the art of neonatal resuscitation. The standard procedure of resuscitation should be followed efficiently. Resuscitation equipment like suction catheters, bag and mask, oxygen cylinder, laryngoscope etc. should be kept ready beforehand. Baby must be provided warmth from a heat source like a heater or a lamp with 200 W bulb to prevent hypothermia.

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Need for referral

An otherwise healthy LBW newborn with a birth weight of 1800 gm or above and gestation of 34 weeks or more can be managed at home by the mother and the family under the supervision of a health worker or a family physician. The indications for hospitalization of a neonate include the following:

- (a) Birth weight less than 1800 gm
- (b) Gestation less than 34 weeks
- (c) Neonate who is not able to take feeds from the breast or by katori-spoon (irrespective of birth weight and gestation)
- (d) A sick neonate (irrespective of the birth weight or gestation)

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Keeping LBW babies warm

Provision of warmth to prevent hypothermia is one of the cardinal principles of newborn care. A baby under cold stress wastes energy and oxygen in trying to maintain temperature. Hypothermia can lead to hypoglycemia, bleeding diathesis, pulmonary hemorrhage, acidosis, apnea, respiratory failure, shock and even death. All this can be entirely prevented by adhering to the following simple measures:

At home

First and foremost, the mother herself is a source of warmth for the baby. It is of immense help to nurse the baby next to the mother, day and night. Further, the room where a LBW baby is nursed should be kept rather warm (temperature between 28°C to 30°C in all seasons). This temperature is slightly uncomfortable for adults, but this discomfort has to be accepted for the sake of the baby. While in summer months no extra effort is required to maintain this temperature, in winter months a room heater may have to be used.

The baby should be clothed well. Two or three layers of clothes are generally required. If the room is not warm enough, woolen sweater should also be put on. Feet should be covered with socks, hands with mittens and head with a cap. Besides, a blanket should be used to cover the baby.

In a rural set-up, it may be necessary to use hot water bottle (filled with lukewarm water at about 39°C) wrapped in double layered clothes to keep baby warm. However, extreme caution should be exercised to prevent accidental burn of the baby while using the hot water bottle.

If a child is maintaining normal body temperature, the trunk feels warm to touch while the soles and the palms are pink and warm. In early stages of hypothermia, the trunk is warm but the soles and palms are cold to touch. This condition, cold stress, is not normal and baby requires additional warmth immediately.

In the hospital

Apart from the above methods, overhead radiant warmer or incubator may be used to keep the baby warm. Regular monitoring of axillary temperature should be carried out in all hospitalized babies. *Refer to topic on hypothermia in newborn.*

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Feeding: deciding the initial method

Presence or absence of sickness and individual feeding ability of the baby determine the decision as to how a LBW neonate should be provided fluids and nutrition. Ultimate goal is to meet both these needs from direct and exclusive breast feeding.

It is essential to categorize LBW infants into two groups based on the hemodynamic stability before deciding the method of feeding.

Hemodynamic status

Infants with any one of the following symptom/signs would be categorized as hemodynamically unstable:

- Fast breathing (RR>60/min)
- Severe chest in-drawing
- Apnea
- Requirement for oxygen
- Convulsions

- Fever (>37.5°C) or low temperature (<35.5°C)
- Abnormal state of consciousness
- Abdominal distension

These infants are usually started on intravenous (IV) fluids. Enteral feeds should be initiated as soon as they are hemodynamically stable with the choice of feeding method based on the infants' gestation and clinical condition (see below).

Feeding ability

The best way to decide if an infant is ready to commence breastfeeding is to observe the infant for developmental feeding signs. Criteria such as a weight or gestational age, though useful, are not accurate enough to determine when a LBW infant is ready for breastfeeding.

Breastfeeding requires effective sucking, swallowing and a proper coordination between suck/swallow and breathing. These complex skills mature with increasing gestation.

The fetus is able to swallow amniotic fluid by as early as 11 to 12 weeks gestation but the coordinated sucking movements are not usually present until about 28 weeks gestation. Single sucks can be recorded at 28 weeks and sucking bursts by 31 weeks gestation. A mature sucking pattern that can adequately express milk from the breast is not present until 32-34 weeks gestation. However, the coordination between suck/swallow and breathing is not fully achieved until 37 weeks of gestation.

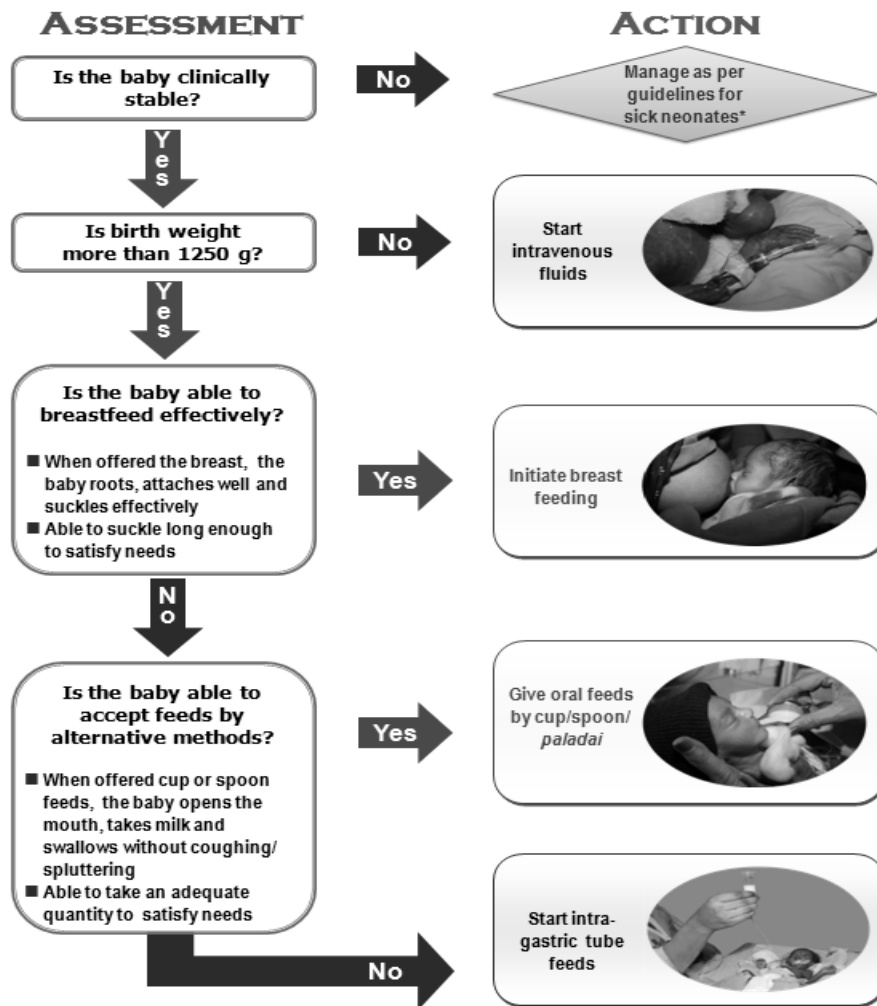
The maturation of oral feeding skills and the choice of initial feeding method at different gestational ages are summarized in the following table:

Gestational age	Maturation of feeding skills	Initial feeding method
< 28 weeks	No proper sucking efforts No gut motility	Intravenous fluids
28-31 weeks	Sucking bursts develop No coordination between suck/swallow and breathing	OG tube feeding with occasional spoon/paladai feeding
32-34 weeks	Slightly mature sucking pattern Coordination begins	Feeding by spoon/paladai/cup

>34 weeks	Mature sucking pattern More coordination between breathing and swallowing	Breastfeeding
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However, it is important to remember that *not all* infants born at a particular gestation would have same feeding skills. Hence the ideal way in a given infant would be to evaluate if the feeding skills expected for his/her gestation are present and then decide accordingly (Figure 1).

Initial feeding method in stable LBW babies

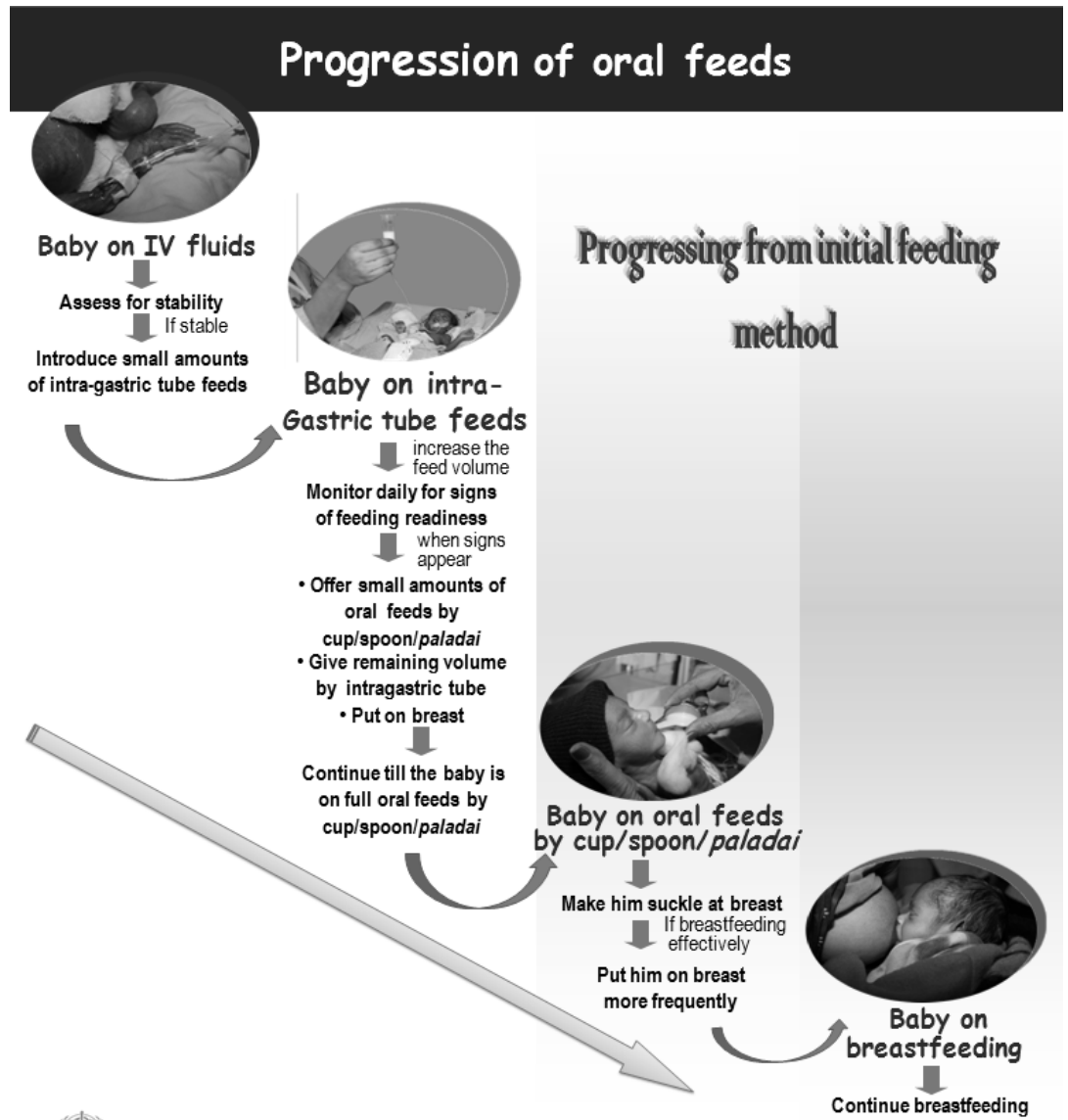


* Assess daily for clinical stability ; once stable, assess for initial feeding method

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Progression of oral feeds

All LBW infants, irrespective of their gestation and birth weight, should ultimately be able to feed directly from the mothers' breast. For preterm LBW infants started on IV fluids/OG tube/paladai feeding, the steps of progression to direct and exclusive breastfeeding are summarized here:



Term LBW infants started on IV fluids (because of their sickness) can be put on the breast once they are hemodynamically stable.

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Choice of milk

Mother's own milk is the best for all LBW infants of all gestational ages.

Breast milk and especially colostrum (the thick, yellowish milk which is produced in small quantities the first few days after delivery) best assures the survival and the well being of LBW infants.

Breast milk is specially adapted to the nutritional needs of the LBW infant; for example, the breast milk of mothers who deliver a preterm LBW infant contains extra protein that is necessary for the normal growth of these infants.

Breast milk provides many anti-infective factors, which are a vital part of the immune system of a newborn baby, and growth factors which help gut development.

There is strong and consistent evidence that feeding mother's own milk to preterm infants of any gestation is associated with lower incidence of infections and better long term outcomes.

For those infants who are not able to breastfeed effectively, oral feeds have to be given by alternative feeding method (cup/paladai/spoon feeding/direct expression into mouth) or by intra-gastric tube feeding.

In these situations, the options available for feeding the LBW infant are:

1. Expressed breast milk (his/her own mother's milk)
2. Donor breast milk
3. Infant formula
 - Standard infant formula
 - Preterm infant formula
4. Animal milk

However, it should be kept in mind that mother's own milk is the best and should be provided to all LBW infants unless the mother cannot or chooses not to provide breast milk.

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Nutritional supplementation

LBW infants require supplementation of various nutrients to meet their high

demands. The requirements of VLBW infants, however, differ significantly from those with birth weights of 1500-2499 grams.

Supplementation for infants with birth weights of 1500-2499g

These infants are more likely to be born at term or near term gestation (≥ 34 weeks); hence, unlike VLBW infants, they do not require multi-nutrient supplementation or fortification of breast milk.

Recommended supplements for infants >1500g			
Nutrient	Route	Dose	Duration
Iron	Enteral	2 mg elemental iron/kg/day (maximum 15 mg/day)	From 2-23 months of age
Vitamin D	Enteral	200-400 IU/day	Until 1 year of age

Supplementation in VLBW infants

These infants who are usually born before 32-34 weeks gestation have inadequate body stores of most of the nutrients. Expressed breast milk has inadequate amounts of protein, energy, calcium, phosphorus, trace elements (iron, zinc) and vitamins (D, E & K) that are unable to meet their daily recommended intakes. Hence, these infants need multi-nutrient supplementation till they reach term gestation (40 weeks postmenstrual age). After this period, their requirements are similar to those infants with birth weights of 1500-2499 grams.

Supplements for breast milk fed infants <1500g				
Nutrient	Route	Dose	When to start?	When to stop?
Phosphorus	Enteral	100 mg/kg	From time of tolerating full enteral feeds	Until 40 weeks post-menstrual age
Calcium	Enteral	200 mg/kg/day	- do -	- do -
Vitamin D	Enteral	400 IU/day	- do -	- do -
Iron	Enteral	2 mg/kg/day	From 2months of age	Until 23 months of age

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Feeding volumes

It is usual clinical practice to provide LBW infants <1500g about 60 ml/kg fluids on the first day of life and increase by 10-15 ml/kg/day to a maximum of 160 ml/kg/day by the end of the first week of life.

Similarly, LBW infants >1500g are usually given about 60 ml/kg fluids on the first day of life and fluid intake is increased by about 15-20 ml/kg/day to a maximum of 160 ml/kg/day by the end of the first week of life.

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Assessment of feeding adequacy

It is important to assess the feeding adequacy in all LBW infants before they are discharged from a hospital/any health facility.

For infants who are being breast fed, the health worker should monitor the adequacy of breastfeeding DAILY.

Some important features that indicate inadequate breastfeeding include:

- Feeding less than 8 times in 24 hours
- Poor attachment and ineffective suckling
- The baby tires or the mother takes him off the breast before completion of feeds
- Mother having sore nipple or breast engorgement

Similarly, the adequacy of feeding should be assessed in those LBW infants who are being spoon-fed. Some features that indicate inadequate spoon/*paladai* feeding include:

- If each feed volume is less than that indicated
- Feeding the baby less frequently than recommended
- If there is excessive spilling during feeds
- Takes too long to finish the required amount

Monitoring should be continued until breastfeeding is fully established and the baby is gaining weight. After discharge, the health worker should make follow up visits weekly during the first two months of life. At these follow-up visits, she should assess for feeding adequacy and also monitor the baby's growth.

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Growth monitoring

Regular growth monitoring helps in assessing the nutritional status and adequacy of feeding; it also identifies those infants with inadequate weight gain.

All LBW infants should ideally be weighed daily till the time of discharge from the hospital (other anthropometric parameters such as length and head circumference should be recorded weekly). Both term and preterm LBW infants tend to lose weight (about 10% and 15% respectively) in the first 7 days of life; they regain their birth weight by 10-14 days. Thereafter, the weight gain should be at least 1-1.5% of birth weight till a weight of 2-2.5 kg is reached. After this, a gain of 20 to 30 g/day is considered appropriate.

Growth charts

Using a growth chart is a simple but effective way to monitor the growth. Serial plotting of weight and other anthropometric indicators in the growth chart allows the individual infant's growth to be compared with a reference standard. It helps in early identification of growth faltering in these infants.

Two types of growth charts are commonly used for growth monitoring in preterm infants: intrauterine and postnatal growth charts. Of these, the postnatal growth chart is preferred because it is a more realistic representation of the true postnatal growth (than an intrauterine growth chart); it also shows the initial weight loss that occurs in the first two weeks of life. The two postnatal charts that are most commonly used for growth monitoring of preterm VLBW infants are: Wright's and Ehrenkranz' charts. Once the preterm LBW infants reach 40 weeks PMA, WHO growth charts should be used for growth monitoring.