

Inadequate growth and nutritional requirements of preterm and term babies



Poor growth occurs in both preterm and term babies, but their nutritional requirements are different. This guide explores the causes of inadequate growth and proposes strategies to ensure these infants receive adequate nutrition to sustain their growth levels.

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Inadequate growth occurs in both preterm and term infants, affecting approximately 5% of children. Preterm infants are especially vulnerable to poor growth since they are born with depleted nutrient stores. This article looks at the possible causes and discusses strategies for nutritional intervention in both preterm and term babies.

PROBLEMS DUE TO PREMATURITY

An infant born before 37 weeks' gestation is defined as premature and because less time has been spent *in utero*, nutritional status at birth is invariably compromised. During the third trimester of pregnancy, the fetus lays down nutrient stores and fat and therefore preterm infants are frequently born with low stores of key nutrients, e.g. iron, calcium and vitamin A, no subcutaneous fat and no sugar stores. In addition, they have higher energy and protein requirements as they will grow quickly in the weeks after birth and need extra calories to meet this challenge. A baby born at 28 weeks' gestation needs to double its weight by 34 weeks' corrected gestation and treble it by 40 weeks – a phenomenal growth rate, which can't always be sustained.

Classifying babies according to weight (<2500g: low birthweight, LBW; <1500g: very low birthweight, VLBW; and <1000g: extremely low birthweight, ELBW) aids in medical and nutritional management. Infants in the latter groups obviously present more of a challenge and experience higher rates of mortality and morbidity.

FALTERING GROWTH IN TERM INFANTS

The term faltering growth or 'failure to thrive'

indicates less than optimal growth. It is noted in approximately 1 in 20 infants, but is difficult to define precisely. It can only be diagnosed after several measurements of weight, height and head circumference have been plotted and inadequate growth documented.

Edwards et al¹ propose that the centile for weight reached by an infant during the first 3 months is the best predictor of the line it should follow thereafter, and a deviation from this 'true centile' involving a crossing of 2 or more centile lines, indicates faltering growth. This highlights some important points:

- Regular, accurate measurements of weight, height and head circumference are necessary to prevent infants remaining undetected.
- It is possible for infants to exhibit poor growth even when their weight is within the normal range of the centile chart, e.g. when weight crosses from 75th centile to 25th centile over a short period.
- Poor growth is indicated if there is a disparity between weight centile and length centile i.e. weight should be plus or minus one centile from the length centile, depending on ethnic grouping and family shape.

Detection and treatment of faltering growth is

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essential to allow infants to achieve adequate growth rates, attain normal neurodevelopment and avoid deficiency states.

POSSIBLE CAUSES OF INADEQUATE GROWTH

The most common cause of poor growth in preterm and term infants is failure to ingest sufficient milk to provide for nutritional requirements, often due to poor sucking and feeding patterns and sometimes due to frequent vomiting and diarrhoea.

Gastro-oesophageal reflux (GOR) leading to vomiting is the second most common cause of inadequate growth, affecting about 1 in 10 babies. It is a self-limiting condition and only a small number of these babies will fail to thrive.

Any concomitant medical condition babies may have will exacerbate their poor growth rate e.g. chronic lung disease. Babies with inadequate growth should undergo a full feeding and medical history and where appropriate relevant investigations, to rule out medical conditions such as cystic fibrosis and congenital heart disease which may lead to poor weight gain. This is because they impose increased requirements for calories (energy) and protein on the infant accompanied by fatigue which makes feeding problematic.

A diverse range of factors are implicated in inadequate growth (SEE TABLE 1.).

NUTRITIONAL CONSIDERATIONS FOR PRETERM INFANTS

Nutrient requirements for premature infants vary, depending on degree of prematurity, size, activity, etc and hence it is vital to have the input of a neonatologist and specialist dietitian to determine needs on an individual basis. As a general guide preterm babies require approximately 150-200mL fluid /kg body weight/day; 120 kcal/kgBW/d and 3-4g protein/kgBW/d.

Some babies are fed parenterally for a period of time but this will not be considered here. The following outlines some feeding strategies used in SCBUs and after discharge to ensure maximum nutrient accretion and prevent inadequate growth.

- Breast milk is the optimal choice of feed for preterm infants and bestows many advantages. Analysis has revealed that preterm mothers produce richer milk for approximately 2 weeks post birth that may match the requirements of heavier babies (ie those >1500g) as a sole source of nutrition during that time. Human milk contains several beneficial factors, eg immunoglobulin molecules, and its use lowers the risk of sepsis, necrotizing enterocolitis and facilitates optimal development of the nervous system.

Factors associated with faltering growth:

- Medical: chronic illness, e.g. heart disorders, cystic fibrosis, infections, malabsorption, metabolic disorders, physical problems that impair intake of food, GOR, developmental delay
- Social: poor parenting skills, including lack of understanding of nutrition; inadequate housing, money and facilities
- Behavioural: poor milk drinkers, fussy eaters, food refusal because of negative associations with feeding.

Additional factors when dealing with preterm infants:

- Low nutrient stores
- High requirements for growth
- Accompanying conditions, e.g. chronic lung disease
- Immature gut and low enzyme levels
- Poor sucking pattern
- Impaired temperature control and a high surface area to body mass ratio.

TABLE 1. Factors associated with inadequate growth.

- Many preterm infants have an impaired suck-swallow-breathe pattern and hence must rely on tube feeding until they can obtain adequate quantities of milk from the breast. The suck reflex develops about 35 weeks post conceptual age.
- Babies who are <2000g, those who are unable to consume or tolerate large quantities of breast milk and those displaying inadequate growth require a breast milk fortifier. These proprietary powders are added to expressed breast milk to boost nutrient density, providing extra calories, protein, vitamins and minerals. Several brands are available, including Nutriprem Breast Fortifier (Cow & Gate) and Eoprotin (Milupa).
- If mother's milk is not available, banked donor milk (previously screened and pasteurised) can be used just to initiate feeding and supplemented as above. In all cases the support of skilled nursing staff in the neonatal unit is vital to overcome the difficulties of expressing and supplementing breast milk during anxious times.
- Where a mother does not want to breastfeed or breastfeeding is contraindicated (very rare), a suitable preterm or low birthweight formula is recommended, e.g. Nutriprem 1 (Cow & Gate).

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These feeds are designed for use on the ward and contain a nutrient profile that supports enhanced growth and tissue accretion in smaller volumes (TABLE 2). Most infants will experience satisfactory growth on approximately 150mL/kg/d although a proportion may require up to 200mL/kg/d. They come in a ready to use format which may decrease the risk of bacterial contamination. There are no definitive guidelines on when to discontinue using preterm formulas and practice varies between neonatal units. Most infants move to another type of feed when they attain a weight of between 2000g and 2500g.

- At discharge, preterm babies frequently weigh less than term babies at birth and hence must continue to grow quickly. Breastfed infants may drink large quantities of milk and take up to 10 feeds each day post discharge. Mothers should be encouraged to feed on demand – supplementation of nutrients like iron depends on local policy.
- Infants on a preterm formula in hospital may be switched to a nutrient enriched post-discharge formula (NEPDF), e.g. Nutriprem 2 (Cow & Gate) or Premcare (Heinz/Farleys). These formulas provide the additional nutrient requirements of infants at home and are prescribable until 6 months' corrected age. Enhanced levels of iron and vitamins may render supplementation with these nutrients unnecessary.
- When an infant has exhibited satisfactory growth or has attained 6-9 months of corrected age, a standard formula can be introduced. If inadequate growth persists, a high energy feed like Infatrini (Nutricia Clinical Care) may then be used (TABLE 2). These high energy feeds are not designed specifically for premature infants and hence do not have nutrient profiles that exactly match discrepancies due to prematurity. However, they are useful because of enhanced energy and protein levels.

NUTRITIONAL CONSIDERATIONS FOR TERM INFANTS

When a term baby is exhibiting faltering growth, the amount of milk taken and/or the frequency of feeding may be increased. Gradual changes should be made over a period of days to aid tolerance. Tube feeding can be used to deliver all or part of the milk especially in sick babies who cannot drink large volumes. Most infants will not tolerate more than 1200mL per day.

- If growth continues to falter a standard formula may be concentrated i.e. 15g of powder added per 100mL instead of the recommended 13g. This should only be done under dietetic or medical advice, once a deficiency in protein or calorific intake, or both, has been established. Care must be taken to avoid dehydration or over concentration of micronutrients and clear instructions must be given to the person responsible for making up the feeds.
- If energy intake is deficient, glucose or glucose and fat polymers may be mixed with the milk e.g. Maxijul (SHS) or Duocal (SHS). It is important not to add too much of these energy supplements to the feed, as at least 10% of calories should come from protein.
- High energy, prescribable milks, eg Infatrini (Nutricia Clinical Care) and SMA High energy (SMA Nutrition) are widely used to combat poor growth. These provide complete nutrition and are ready to use, obviating the need for mixing, and thus decreasing the risk of bacterial contamination and preparation errors. They are useful in both the hospital and home environment.

The involvement of a paediatric dietitian in the nutritional management of all babies with faltering growth is essential, particularly as requirements and hence regimes constantly change as the child grows.

CONCLUSION

Preterm, low birthweight babies have deficient nutrient stores and therefore need a breast milk fortifier or a special preterm or low birthweight formula whilst in hospital, and subsequently a post-discharge formula to maintain their growth rate. Term babies with faltering growth require high energy and protein levels which can conveniently be provided by a high energy feed.

REFERENCES

- 1 Edwards, A., Halse, P., Parkin, J., Waterston, A. Recognising failure to thrive in early childhood. *Arch Dis Child* 1990; **65**: 1263-65.
- 2 Tsang et al. Nutritional Needs of the Preterm Infant. Scientific basis and practical guidelines. 1993. Williams & Wilkins, Baltimore.

Nutrients per 100mL of feed	Nutriprem 1 (Cow & Gate)	Nutriprem 2 (Cow & Gate)	Standard infant formula	SMA High Energy (SMA Nutrition)	Infatrini (Nutricia Clinical Care)
Energy/ 100mL (kcal)	80	75	67	91	100
Protein (g)	2.4	2	1.4	2	2.6
Fat (g)	4.4	4.1	3.5	4.9	5.4
Carbohydrate (g)	7.9	7.5	7.5	9.8	10.3

TABLE 2. A comparison between different types of infant feeds.