Feeding and Nutrition in Infants and Children

Student Resource Pack 2010 - 2011
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Introduction

This resource pack has been produced to provide a range of materials in the area of feeding and nutrition in infants and children. The pack includes a variety of documents on topics such as breastfeeding, formula milk, weaning, dietary guidelines, nasogastric tube feeding, soya proteins in milk, feeding behaviours and a comprehensive list of additional reading.

This pack has been developed and produced as a result of the work of the Centre for Excellence in Interprofessional Education at Queen’s University Belfast.
Copyright Statement

The following items in this pack are copyright © 2009 Queen’s University Belfast and Belfast Health and Social Care Trust:

- Learning outcomes
- Nutrition Lecture
- Nutritional Assessment in Clinical Practice
- Indications for supplementary feeding
- Infant Feeding Behaviours
- Case studies 1-10
- Additional Reading

The copyright ownership in this pack does not include the following external sources, individually acknowledged or referenced within this pack:

- British Dietetic Association Paediatric Group Position Statement: Weaning onto solid foods
- British Dietetic Association Paediatric Group Position Statement: Use of infant formulas based on soy proteins for infants
- Nutritional Composition of Infant Formula:
  - Whey dominant milks
  - Casein dominant milks
  - Pre term milk
  - Follow on milk
- Dietary Reference Values
- Portion Sizes for Different Age Groups
- General Guide to Oral Requirements in Sick Children
- National Patient Safety Agency: How to confirm the correct position of nasogastric feeding tubes in infants, children and adults

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</table>

The contributors of this resource pack thank Mr Mark McCalmont (Centre for Excellence in Interprofessional Education, QUB) for the compilation of the pack.
Learning Outcomes

Knowledge

The successful student should:

- know fluid and calorie requirements in infancy and childhood
- be familiar with current infant feeding and weaning guidelines
- know nutritional composition of breast and (common) formula milks
- be able to identify and manage common nutritional problems in infancy and childhood
- be aware of specialised nutritional requirements in infants/children with medical diseases and how these are managed
- be aware of factors contributing to childhood obesity and the short and long term consequences
- be aware of the impact of family, environmental and medical factors on the feeding process

Skills

The successful student should be able to:

- take a detailed feeding history e.g. 24 hour dietary recall
- prepare an infant formula feed
- feed a baby with formula milk and food
- pass a nasogastric tube and administer tube feed
- plot and interpret growth measurements on appropriate centile charts

Attitudes

The successful student should:

- appreciate the role of various professionals in managing feeding problems in infants and children
- be aware of implications of feeding difficulties for infant/child, carers and professionals
- be aware of the bonding and attachment issues in relation to early infant feeding

In keeping with the requirements of your professional body (e.g. General Medical Council: http://www.gmc-uk.org/, Nursing & Midwifery Council: http://www.nmc-uk.org/), you are expected to use this opportunity to work in teams. It is important to remember that when presenting case scenarios we will be looking for evidence of team working.

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Infant Feeding

Infant formulas can be divided into 2 categories:

- Whey based milks
- Casein based milks
- Ideally the whey/casein ratio should resemble that of breast milk

Infant Formulas

Whey based
- Aptamil First
- Cow & Gate 1
- Farley’s First Milk
- SMA Gold

Casein Based
- Aptamil Extra Hungry
- Cow & Gate 2
- Farley’s Second Milk
- SMA White
Infant Formulas

**Whey based**
- Whey forms softer curds and is more easily digested
- Renal solute load/protein composition more closely resemble breast milk

**Casein based**
- Casein takes longer to digest and promotes slower gastric emptying
- Often recommended for “hungrier babies” but no scientific rationale to support this

Infant Feeding

- If bottle feeding, encourage the use of whey based milks.
- Increase quantity and/or frequency rather than change the baby milk used.
Preparation of Infant Formula

- Add 1 scoop milk powder to 1 fl oz / 30ml water
- Always add powder to water
- Scoops are not interchangeable
- Scoops should not be heaped

Follow-on Milks

Iron Content / 100 ml

- Cow & Gate 3: 1.3 mg
- SMA Progress: 1.3 mg
- Farley's Follow On: 1.2 mg
- Aptamil Follow On: 1.3 mg
- Cow’s milk: 0.03 mg
Follow-on Formulas

- Suitable from 6 months
- May be useful if weaning diet is iron deficient
- Higher in iron
- Can be continued up to 18 months if diet poor

Fluid Requirements in Newborns

- Demand breast feeding ensures correct volume of milk
- Breast feeders regulate their own milk intake
Fluid Requirements

<table>
<thead>
<tr>
<th>Age</th>
<th>Approx weight (kg)</th>
<th>Fluid ml / kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Premature</td>
<td>1 - 2</td>
<td>150 - 200</td>
</tr>
<tr>
<td>0 - 6 months</td>
<td>2 - 8</td>
<td>150</td>
</tr>
<tr>
<td>7 – 12 months</td>
<td>6 - 10</td>
<td>120</td>
</tr>
</tbody>
</table>

Fluid Requirements – Older Children

For children over 10kg, normal fluid requirements can be calculated as follows:

- 11 – 20kg
  - 100mls/kg for the first 10kg
  - +50mls/kg for the next 10kg

- 20kgs and above
  - 100mls/kg for the first 10kg
  - +50mls/kg for the next 10kg
  - +25mls/kg thereafter
  - up to 2500mls per day maximum
### Number of Daily Feeds

<table>
<thead>
<tr>
<th>Approx age</th>
<th>Approx vol. per feed</th>
<th>No. feeds/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 – 2 wks</td>
<td>50 - 70 ml</td>
<td>7 - 8</td>
</tr>
<tr>
<td>2 – 6 wks</td>
<td>75 - 100 ml</td>
<td>6 - 7</td>
</tr>
<tr>
<td>2 months</td>
<td>110 - 180 ml</td>
<td>5 - 6</td>
</tr>
<tr>
<td>3 months</td>
<td>170 - 220 ml</td>
<td>5</td>
</tr>
<tr>
<td>6 months</td>
<td>220 - 240 ml</td>
<td>4</td>
</tr>
</tbody>
</table>

### Expected Growth in Childhood

Normal birth weight: 3.3 - 3.5kg  
Wt loss day 5 - 7, regain birth wt by day 10 - 14

<table>
<thead>
<tr>
<th>Age</th>
<th>Weight</th>
<th>Height</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 3 months</td>
<td>200g / wk</td>
<td>10 cm</td>
</tr>
<tr>
<td>3 - 6 months</td>
<td>150g / wk</td>
<td>7 cm</td>
</tr>
<tr>
<td>6 - 9 months</td>
<td>100g / wk</td>
<td>3 cm</td>
</tr>
<tr>
<td>9 - 12 months</td>
<td>50 - 75g / wk</td>
<td>4 cm</td>
</tr>
<tr>
<td>1 - 2 yrs</td>
<td>2.5kg / per year</td>
<td>12 cm</td>
</tr>
<tr>
<td>2 yrs+</td>
<td>2.0kg / per year</td>
<td>10 cm</td>
</tr>
</tbody>
</table>

(Height decreases to 6 cm per year until puberty)
When to Wean

‘Breast feeding is the best form of nutrition for infants. Exclusive breast feeding is recommended for the first six months (26 weeks) of life as it provides all the nutrients a baby needs’. (Department of Health, May 2003)

Weaning

Stage 1  (6 months)

☐ Consistency - thin, smooth and semi solid

☐ Give baby rice, puree fruits, vegetables, potatoes, custard

☐ Avoid salt and sugar

☐ Avoid wheat and gluten until 6 months
6 months

Stage 2 (7 - 9 months)

- Increase texture - minced, mashed
- Coarsely puree meat
- Oat cereal, Weetabix
- Offer solids three times daily
- Decrease milk feeds to 3 - 4 times per day
- Encourage drinks from a cup/beaker
- Introduce finger foods e.g. toast, soft fruit, cooked veg
- Use cow’s milk in foods, NOT as a drink
7 - 9 months

Stage 3 (10 – 12 months)

- Consistency:
  - minced and chopped

- By 1 year:
  - family meals
  - aim to discontinue bottles
10 - 12 months

Constipation

- Constipation does not usually occur in the breast fed infant, the passage of stool may vary from after each feed to once every 10 days
- Bottle fed babies can produce a harder stool
- Check fluid intake
- Check the number of scoops of infant formula used
Constipation cont’d

☐ Check number of wet nappies
☐ Give extra fluid as cooled previously boiled water or well diluted orange juice (1:4)
☐ Constipation maybe a presenting feature of Hirschsprung’s disease in the older child
☐ Constipation is common in toddlers who drink more than 600ml milk per day, have poor appetite and are fussy eaters
☐ Short term use of Lactulose

Advice to Parents

☐ Reduce milk intake especially if >1yr
☐ If > 1yr stop all bottles
☐ Regular meals and snacks should be encouraged; meals should not be replaced by bottles or sugary snacks
☐ Fluid: at least 6 cups per day (water/dilute squash/fruit juice)
☐ Try to increase fibre intake i.e.
  ■ Cereals - Porridge / Weetabix / Ready Brek
  ■ use of some wholemeal / granary / wheaten / high-fibre white bread
☐ Encourage fruit and raw vegetables
☐ Bran is not recommended.
Faltering Growth

Definitions

- Weight deviating from height
- Weight deviating 2 or more major centiles from height
- Organic and non-organic FTT
- Classify by cause:
  - inadequate intake
  - losses
  - failure to absorb
  - failure to utilise
  - requirements

Faltering Growth <1yr

Causes

- Too little in
- Too much out
- Failure to absorb
- Failure to utilize
- Increased requirements
Inadequate Intake

- Poverty, ignorance, neglect
- Poor appetite
- Fear of feeding
- Oral hypersensitivity
- Reflux/vomiting
- Poor oromotor skills
- Limb abnormalities/poor head or trunk control
- Poor dentition

Increased Losses

- Nephrotic Syndrome
- Exfoliative Dermatitis
- Burns
- Poorly controlled Diabetes Mellitus
Failure to Absorb

- Cystic Fibrosis
- Coeliac Disease
- Enteropathies
- Biliary Cirrhosis

Failure to Utilise

- Endocrine Disorders
- Inborn Errors of Metabolism
- Infection
Increased Requirements

- Prematurity
- Bronchopulmonary Dysplasia
- Cystic Fibrosis
- Congenital Heart Disease
- Catch up growth after illness

Incidence of Faltering Growth

- Can affect up to 5% of children under 5 (Batchelor & Kerslake, 1990)
- 93 - 98% cases non-organic (Underdown & Birks, 2000)

Facts About Faltering Growth
(The Children’s Society)

- Occurs across all socio-economic groups
- Occurs because of calories
- Misleading to categorise as organic & non-organic
- Most cases no organic cause
- Many children have intrusive & inappropriate medical tests to eliminate organic causes
- Neglect/abuse accounts for tiny minority of cases
- Emotional deprivation not a major cause
- Difficulty feeding most common factor cited

Cycle of Interactions Compounding Feeding Difficulties (Batchelor, 1999)
Faltering Growth – Assessment by MDT

- Underlying organic disease
- Nutritional status e.g. weight, height, growth
- Nutritional intake - all food/drink
- Symptom history
- Feeding history - feed volume/preparation
- Oromotor function
- Feeding behaviour - observe if possible
- Social assessment
- Development assessment

Management of Faltering Growth

- Assessment of requirements
- Normal requirements - growth maintenance
- Additional protein & energy for growth
- 9% energy from protein
- Manipulation of diet to nutrient density
- Use of dietary supplements
- Enteral feeding
Nutritional Management of Faltering Growth

ENERGY

Suggested formula (MacLean et al 1990)

\[ \text{Kcal/Kg} = 120 \times \text{ideal weight for height (Kg)} \]
\[ \text{Actual weight (Kg)} \]

PROTEIN

Minimum 90% necessary to achieve maximum nitrogen retention in malnourished children

General Guide to Oral Requirement (Great Ormond Street Hospital)

Infants 0-1 year (based on actual weight, not expected weight)

<table>
<thead>
<tr>
<th></th>
<th>Normal</th>
<th>High</th>
<th>Very High</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Energy (kcal/day)</strong></td>
<td>100 - 115</td>
<td>130 - 150</td>
<td>150 - 220</td>
</tr>
<tr>
<td><strong>Protein (g)</strong></td>
<td>1.1 – 2.1</td>
<td>3.0 – 4.5</td>
<td>6.0 (0-6 mths) max 10g/kg/day up to 1 year</td>
</tr>
<tr>
<td><strong>Sodium (mmol)</strong></td>
<td>1.5</td>
<td>3.0</td>
<td>4.5</td>
</tr>
<tr>
<td><strong>Fluid (ml)</strong></td>
<td>150</td>
<td>150 - 200</td>
<td></td>
</tr>
</tbody>
</table>
Supplementation of Infant Feeds

- Concentrating infant formula: from 13% to 15%
- Extra calories:
  - CHO/FaT i.e. Duocal
  - CHO i.e. Maxijul, Calogen
  - Fat i.e. Calogen (LCT) or Liquigen (MCT)
- Nutrient dense formulas e.g. SMA High Energy, Infatrini

Nutritional Management of Older Child

- Establish regular meal pattern
- Appropriate texture/thickened fluids
- Food fortification
- Use of dietary supplements
- Enteral feeding if necessary
Dietary Supplements

Enteral Feeds
Iron Deficiency Anaemia

Anaemia ⇒ ↓ intake iron containing foods
↑ intake cow’s milk
cow’s milk main drink < 1yr

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### Haem-Iron
- Red meat i.e. beef, lamb or pork
- Beef burgers
- Black pudding
- Liver, kidney
- Liver paté
- Tinned sardines

### Non-Haem
- Egg
- Beans i.e. baked
- Lentils
- Fortified breakfast cereals
- Wholemeal bread
- Green leafy vegetables
- Dried fruit i.e. apricots
Good Sources of Vitamin C

- Citrus fruit e.g. oranges, satsuma
- Strawberries, kiwi fruit, peaches and nectarines
- Potatoes, tomatoes, frozen peas
- Green leafy vegetables, broccoli

Prevention of Iron Deficiency Anaemia

**Encourage:**
- Breast feeding/use of infant formula until 1yr
- Introduction of iron rich weaning foods from 6 months
- Use of adapted family foods, containing iron or vitamin C
- Use of vitamin drops until 5 yrs
- Regular meals with family
Prevention of Iron Deficiency Anaemia cont’d.

Discourage:

- The early introduction of crisps, sweets, chocolate, fizzy drinks
- Use of bottle beyond 12 months
- Use of no more than 1 pint milk/day over 12 months
- The use of added sugar or sweet commercial baby foods

Lactose Intolerance

- Lactose intolerance most commonly occurs secondary to viral enteropathy
- It is a transient condition and resolves spontaneously in the majority of infants
- Test stools for reducing substances
- If negative consider alternative diagnosis
Treatment of Lactose Intolerance

- Refer to dietitian
- Commence lactose free formula such as Enfamil O-Lac or SMA LF or Soya based formula (if baby older than 6 months)
- Commence low lactose diet for age if necessary
- Review in 6 weeks
- Check weight
- Reintroduce infant milk and stop low lactose diet

Older Children

- Supermarket calcium enriched soya milks can be used over 2 years of age (calcium enriched if possible)
- Advise on low lactose diet
Cow’s Milk Protein Intolerance

Relatively high incidence of adverse reactions to food proteins in infancy
- Immaturity of immune system
- Increased gut permeability to large molecules
- IgA deficiency involved in immune defense mucosal surfaces
- CMPI most common, range of estimates
- 5-15% show symptoms of CMPI
- 2-7.5% prevalence
- 0.5% breast fed infants


Host, A. (1994) Cow’s milk protein allergy and intolerance in infants. *Pediatric Allergy and Immunology*, 5 (5 suppl 1) 36

Cow’s Milk Protein Intolerance

- Less than 1% maintain lifelong allergy
- Remission
- 45-50% infants by 1 year of age
- 60-75% by 2 years of age
- 85-90% by 3 years of age
- Adverse reactions to other food groups develops in approx 50%


Host, A. (1994) Cow’s milk protein allergy and intolerance in infants. *Pediatric Allergy and Immunology*, 5 (5 suppl 1) 36
Allergy / Intolerance

Antibody mediated
- IgE mediated
- Urticaria, angioedema
- Immediate GI hypersensitivity
- Oral Allergy Syndrome

T cell mediated
- Dietary protein enteropathy
- Protein induced enterocolitis
- Protocolitis


Common Symptoms of Cow’s Milk Protein Allergy – Organ Involvement Symptoms

- **GI tract**
  - Frequent regurgitation, vomiting, diarrhea, constipation, blood in stool, iron deficiency anemia

- **Skin**
  - Atopic dermatitis, urticaria not linked to infections or medication, swelling of lips or eyelids

- **Respiratory tract** (not related to RTI)
  - Runny nose, otitis media, chronic cough, wheezing

- **General**
  - Persistent distress, irritability or colic, at least 3 days/week for >3 weeks

CMPI: Reactions and Symptoms

- Early skin reaction less than 45 mins
- Early gut reaction 45 mins to 20 hours
- Late reaction over 20 hours
- Majority > 2 symptoms and symptoms from 2 or more organs
- 50-70% skin symptoms
- 50-60% GI symptoms
- 20-30% respiratory symptoms
- Slower onset more common, non IgE - includes loose stools (+/- blood) vomiting, irritability, colic


Investigations

- Skin prick testing (SPT)
- Radioallergosorbent test (RAST)
- Specific IgE
Guidelines for Management

- Breast fed babies: maternal dietary exclusion
- Bottle fed under 6m: hydrolysed formula e.g. nutramigen, pepti junior
- Dietary exclusion
- **AVOID:**
  - Milk, Milk powder, Milk solids, Casein, Whey, Lactose, Butter, Cheese, Cream, Yogurt, Whey syrup sweetener
- Supervised milk challenge at 18mths-2yrs


Discussion

- Possibility of nutritional deficiencies
- Time consuming
- Expensive
- Use of formula that is hydrolysed (should be tolerated by 90% of those with CMPI)
- Soya is not recommended below 6m of age
- 60% cross over allergenicity and phytoestrogen content

(American Academy of Pediatrics committee)
Obesity in Childhood

- Prevalence 13-14 year olds, NI
- Males 16% overweight, 4% obese
- Females 16% overweight, 2% obese

(Yarnell et al, 2001)

Prevalence of Obesity – Mean BMI

<table>
<thead>
<tr>
<th>Age (yrs)</th>
<th>Male</th>
<th>Female</th>
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<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean (std)</td>
</tr>
<tr>
<td>4</td>
<td>50</td>
<td>16.7 (1.4)</td>
</tr>
<tr>
<td>5</td>
<td>356</td>
<td>16.6 (1.7)</td>
</tr>
<tr>
<td>8</td>
<td>131</td>
<td>17.1 (1.9)</td>
</tr>
<tr>
<td>11</td>
<td>47</td>
<td>19.3 (2.9)</td>
</tr>
<tr>
<td>12</td>
<td>115</td>
<td>19.7 (3.3)</td>
</tr>
<tr>
<td>13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>108</td>
<td>21.6 (3.8)</td>
</tr>
<tr>
<td>15</td>
<td>198</td>
<td>21.7 (3.6)</td>
</tr>
</tbody>
</table>

Obesity in Childhood

Multifactorial in aetiology
- Behavioural
- Psychological
- Physiological
- Medical conditions
- Genetic predisposition
- Obesogenic environment
- Social class
- Ethnicity

Assessment
- Weight and height and BMI should be plotted on percentile charts
- Waist circumference
- A weight of more than two centiles higher than height
- BMI plotted on percentiles and greater than 99.6th centile
- Diet history, especially snacks and drinks
Management

- Evidence to support multi-faceted approach with children and families where parent takes responsibility for change. Includes nutrition education, physical activity, advice to reduce sedentary behaviour, modification of school meals and tuck shop.

- Exercise programmes

- Lack of evidence to support programmes without parents involved e.g. school based interventions, however 11 out of 12 studies intervention groups had on average 10% reduction in weight. Long term benefits not known.

- Lack of evidence to support family targeted health promotion.


Diet: Practical Steps to Reduce Energy Intake

- Reduce amount of fried foods and amount of fat added in cooking.
- Remove visible meat off meat or use low fat varieties (round steak mince, low fat sausages).
- Thick slices of bread and less spread or low fat version. Don’t add to vegetables.
- Limit amount of chocolate, sweet cakes, biscuits and ice-cream.
- Give vegetables or salad at meals.
- Give fruit, sugar free jelly, low fat yoghurt as desserts.
- Balanced diet.
Nutritional Assessment in Clinical Practice

Height measurement is usually undertaken from the age of 2 years, and supine length before this time. Length increases by approximately 25cms in the first and 12cms in the second year of life; by two years of age roughly half the adult height is reached. Maximum head circumference is determined by measuring from the mid-forehead to the occipital prominence. Head circumference at birth is approximately 75% of adult size, increasing by 1cm/month in the first year, and by just 2cms in the second year; by two years of age roughly half the adult height is reached.

Maximum head circumference is determined by measuring from the mid-forehead to the occipital prominence. Head circumference at birth is approximately 75% of adult size, increasing by 1cm/month in the first year, and by just 2cms in the second year; by two years of age roughly half the adult height is reached.

Skinfold thickness measured over the triceps (TSF) using skinfold callipers gives an indication of subcutaneous fat (energy) stores. Mid-arm circumference (MAC) is measured using a non-stretch tape half way between the acromion of the shoulder and the olecranon of the elbow and is an index of energy and protein stores. Age and sex specific reference data for TSF and MAC are available. The MAC and TSF measurements (mm) can be used to calculate upper arm muscle area and fat area, clinical indicators of total body stores of muscle and fat.

References


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Indications for Supplementary Feeding

Additional calories added to feeds

- increased requirements, e.g. chronic diseases, deprivation
- inability to tolerate “volumes” e.g. infants with congenital heart disease, renal conditions
- feeding difficulties, e.g. oral motor problems

Nasogastric feeding

- inadequate oral intake
- oral motor problems
- “unsafe” oral feeders
- acute illness, e.g. infants/children in PICU
- reliable route for medication

Gastronomy tube

- prolonged e.g. feeding
- gastro-oesophageal reflux (can worsen!)
- anomalies of upper GI tract
- duration feeding (<3 hours/day)

NB Decision on feeding should be a partnership between parents and professionals
Feeding Behaviours

This chapter was written for parents of children born with a congenital heart defect, therefore there are many references to this group of children. However much of the advice is applicable to all children who have feeding difficulties irrespective of diagnosis.

Feeding is one of the first and most basic ways in which a parent cares for, interacts and thus bonds with, their baby. However feeding is a very emotive area that can cause much distress for parents when things don’t go well. From the outset it is important to remember that difficulties with feeding are very common (almost "normal") in infants born with significant heart problems. This happens for a variety of reasons. One basic reason is because sucking and feeding require a lot of energy - the heart has to work hard.

When the infant has a congenital heart defect the limitations in the heart make this very difficult. Therefore the baby often feeds very slowly, may tire easily, or may become breathless or sweaty when feeding. In this chapter we first of all describe normal developments in feeding behaviours - which apply to all growing infants. Then we look at the special challenges congenital heart disease poses and some of the strategies you might use to overcome these.
Typical feeding stages

The various stages in the development of feeding are summarised below:

*Milk by bottle or breast*

Weaning

*Plain smooth foods such as baby rice, mashed banana*

Pureed foods – help stimulate 4 tastes

*Food with gradually more texture to help baby work mouth muscles*

Finger Foods

**Milk**

The first stage in feeding relates to milk. The baby takes milk either from its mother’s breast or by bottle. Breast feeding is often recommended as breast milk is a complete food and can provide the baby with some immunity against disease. However, a great many mothers find breast feeding difficult, at least at the start. It can take two or three weeks for breastfeeding to become properly established, but even a little breast milk, for even a brief period of time, perhaps supplemented by other sources of nutrition, will be beneficial for your baby. If you find that you are unable to breast feed don’t worry. The most important thing, as we discuss later, is that you and your baby are as relaxed and happy as possible when feeding, so it is not worth pushing breast feeding TOO far if it is adding stress and worry at a time when you have enough of that already!
If your baby is not gaining weight very well, and needs extra calories, these can be given to the bottle fed baby in the form of calorie supplements to formula, or as high energy milk. Breast milk fortifier, or calorie/protein supplements, can be added to expressed breast milk to give the breastfed baby extra calories. *Duocal, Maxijul* and *Calogen* are the names of calorie supplements, which may be added to normal infant formula such as *SMA Gold, Cow & Gate Premium* and *Aptamil First*. *SMA High Energy* and *Infatrini* are two of the high energy infant formulas. Your dietician will work out your baby’s energy requirements and is the best person to advise you about the feed needed to meet your baby’s needs.

**Weaning**

Weaning is the process that teaches your baby:

- To expand the range of foods taken and so experience different tastes and textures
- To learn how to bite and chew
- To use a spoon
- To drink from a cup

DOH guidelines are that solids (weaning) should be 1st introduced at 6 months. Sometimes parents of children with congenital heart defects are advised to start spoon feeding at a slightly earlier age as it takes so much energy to suck from a bottle. When weaning use a small plastic baby spoon and initially only use a small amount of food on its tip and place it in the baby’s mouth. If your baby refuses this food at the start don’t worry. It is a new experience for your baby and you can try giving the food again in a few days.

Recent research tells us that one of the most important things which needs to happen at this stage is for your baby's main taste centres to be
stimulated and developed. This will widen the range of foods which they will later accept as growing infants. If weaning is delayed too long there may be later difficulties with getting your baby or toddler to accept new foods. They do NOT need to RELY on weaning foods for all their energy - they simply need early experience (no matter how small) with different food tastes. You will find that many of the foods you eat as a family are suitable for introducing the full range of tastes to your baby, for example potatoes, vegetables, yoghurts and fruit. Dishes such as stews, potato pies etc can be pureed when your baby is slightly older. It might be better to separate a portion of food for your baby if salt, sugar or spices are usually used in your cooking.

Different tastes can be introduced even if the baby is mainly fed by NG tube (see later in the chapter). A small amount of each of the food tastes can be presented to the child by placing on the child’s lip. The child will generally lick the lip and so experience the taste. A look of disgust does not necessarily mean that the taste isn’t liked but may reflect the newness of the taste. It is okay to reintroduce the taste later.

Gradually your baby will take more and more solid food and less milk, however milk is still an important part of the diet and it is recommended that babies continue with breast milk and/or infant formula throughout their first year.

**Introducing different textures in food**

Exposure to a variety of textured foods seems to be very important for normal mouth and tongue development. It allows the child to develop the mouth movements needed to chew food and move it about the mouth. The movements needed to do this are different from those used to swallow milk.
By nine to twelve months of age your child should be able to finger-feed soft table foods. Breast or bottle feeds should be continued until at least 1 year of age.

The challenges posed to feeding by congenital heart disease

There are some things that make feeding difficult which are mainly outside of your control as a parent. However, there are other things which you CAN do something about. This section looks at the challenges to normal feeding posed by congenital heart disease and some of the things you might do to minimise or overcome these problems.

Physical limitations

As mentioned above, when the infant is born with a congenital heart defect, the heart may not, at least until after surgery, be working as efficiently as it should. This means that their heart may have to work harder and your child will tire easily from all the effort and energy used. This is why such infants naturally may need more sleep and rest than other infants. Since a lot of energy is used when sucking and feeding they may become more breathless than other infants and lack energy. Feeding may, therefore, take much longer – they may even fall asleep at the teat! Other physical problems which some children have (e.g. reflux) will make things even more difficult.

The first thing which will help you here is acceptance. For many infants with congenital heart disease (CHD) slow, breathless, feeding is more of the norm than the exception. Trying to force the pace, or struggling to make the tired and breathless infant take more and more may backfire. You and your baby will become
stressed, which will only make matters worse. The infant may even vomit up whatever they have taken in.

In this situation it may help to give smaller amounts of milk and to feed the baby more often. Also start to notice the signals your baby gives out when they need a rest or a pause in feeding. Pause and rest at these times and perhaps sing or talk to your baby to keep them feeling relaxed and contented. Remember all this “pause” time between sucking is helpful to infant bonding. You will come to learn to recognise your baby’s signals that they are ready to start feeding again (perhaps she/he will root around or show mouthing behaviours). Feeding will often take longer but you should be patient and accepting of this fact. Feeds (including burping and rests) should not, however, last longer than 20-30 minutes. Whilst patient perseverance is important here, you should also become aware of distress signals which your baby will give you when they really have had enough and further attempts at feeding would only be upsetting. If you persevere with feeding when your child has become upset, she/he will only start to associate feeding with distress and upset and the whole thing will become even more difficult.

You should also remember that if the quantity of milk the baby can take in is reduced, it is always possible to add calories to the feed so that they get the energy they need. Sometimes, however, if feeding goes through a particularly difficult phase, the baby may need to be tube fed for a time.

The tube fed baby

There are times when it is not possible to feed your baby orally. This might happen because your baby is too unwell to take the food orally or needs to gain weight (e.g. for surgery) and is not able to get enough energy orally. The baby may then get the majority of
the nutrition required via NG tube. Although decisions to tube feed your baby are only ever made if it is essential to your baby’s health and well-being, this can sometimes make oral feeding difficult in the future. There are some things which you can do to minimise the effects of this.

Despite the need for tube feeding it is still possible to interact with your baby and help make the times of food intake positive experiences. These times can be helped by holding the younger infant close as you would if giving milk feeds and engaging in eye contact and smiles just as you would if bottle or breast feeding. For the infant who could be eating solids the time of tube feeding can also be a time of positive interaction. They can be seated or held as they would be if spoon fed and benefit from eye contact and interaction.

In addition to this, and regardless of the developmental stage that the baby is at, you should also make sure that your baby continues to receive oral stimulation during this period (that is help the baby experience pleasurable sensations inside their mouth). This can occur by regularly introducing small amounts of different foods inside the lips to stimulate taste and, for texture, through using a small amount of different textured foods or by allowing him/her to explore different textured objects with their mouth. This means that even if your child is being tube fed during the time in their development when tastes and textures should be introduced, that they will still have these experiences. Food experience is the important thing – they do not need to rely on these small bits of food for their energy.

We know too that a dummy is a positive and useful item to be used when the child gets only a little food by mouth. This helps stimulate the use of mouth and tongue muscles. Sucking is particularly useful during tube feeding, as the baby learns to associate activity in the mouth with feeling a fullness in

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the tummy. Speech and language therapists have the most knowledge about the best way to stimulate the mouth and tongue and you can discuss this further with them.

The importance of parent-infant interaction during feeding

As discussed earlier, feeding provides a very good opportunity to interact with your baby. The position in which the baby is held during feeding allows both close body and eye contact which increases bonding. Feeding has what has been called a ‘burst-pause’ pattern - there are bursts of sucks followed by pause. As a baby sucks mum is generally quiet, allowing the baby to concentrate on feeding. During a pause however the mother may talk or sing to and touch her baby. Then there is a return to sucking when the baby is ready. This type of turn taking actually helps the social interaction between parent and baby and helps the infant develop its “turn-taking” social skills. Moreover, a relaxed, happy pattern of such social interaction between the parent and the baby helps the baby to form very pleasant associations with feeding.

A happy feeding interaction, like that described above, is helped by a calm and relaxed parent. It is also dependent on each reading the “signals” that the other is giving out. If a baby presents unclear and confusing signals, this interferes with the interaction, the parent in turn is unsure how to respond, is not consistent and starts to give out signals of stress and tension. The baby picks up on these signals and becomes more distressed and alarmed itself, which in turn can make the parent give out even more signals of tension. The natural, easy-flowing and relaxed feeding interaction breaks down. Feeding then
becomes difficult and unsatisfactory for both parent and child. Both approach the next feeding episode with some anxiety and a whole vicious circle of negative interaction patterns follows. Such a situation increases, or is even at the root of, many feeding difficulties. Remembering the following will help you to minimise such problems:

- Be aware that as a result of the heart problem, your baby’s feeding can be naturally difficult and he/she may show less clear signals, and be less responsive to you during feeding, than a baby who does not have a heart problem. Understanding and accepting this, is the first important step in helping you overcome it. Parents can get frustrated by the feeding difficulties and may blame themselves. It is important to remember that the difficulties are not your fault but have arisen because of the heart condition.

- We have discussed the importance of feeding “signals” and “cues”. We all respond to cues that it is time to eat (sight, smell of food, time of day etc.) and these cues often increase our feelings of hunger and actually prepare our bodies for food. Young babies also feed best when feeding is predictable and signaled like this. Thus it is a good idea to start feeding sessions in ways which are consistent (i.e. the way you position or hold the baby, have a feeding time lullaby or rhyme etc.). These will come to signal to baby that feeding time is approaching and this predictability will help feeding. It also means that for the baby who has feeding difficulties, s/he will know when being picked up, or spoken to, does NOT mean that a bottle is about to also be produced!

- Adults eat best in pleasant and relaxed atmospheres and the same is true for babies and children. Feeding will become more pleasant and enjoyable for the infant if it is
associated with being held snugly, feeling safe and secure, being soothed and sung to, having the attention and eye contact with the parent etc. A relaxed and calm parent will help here. Try to leave aside your tensions and anxieties during feeding time, even though this is understandably a difficult thing to do.

- Force feeding and constant coaxing does not help a child feed better in the long run. In fact the infant is likely to find the whole situation distressing and will start to find feeding time a situation best avoided. Food signals and cues will become enough to set them off into a crying fit. Be sensitive to his/her signals that s/he needs to rest. Be patient and give him/her the necessary recovery time. Also be sensitive to signals that s/he has had enough and needs to stop feeding or is finding it distressing. It is best to end feeding on a positive, happy note than to persevere and end up with the infant AND parent in a state of distress. There are clear cues that the baby is becoming full and nearing the end of a feed. These involve several stages. First the baby slows down its sucking rate and then becomes drowsy. If a parent continues to feed, the baby will refuse to open its mouth or will spit out the teat if it is forced into his mouth. If the baby is still wanting to feed, but is just tired and fatigued, s/he will open the mouth again and continue to try sucking after a rest (if s/he has not already fallen asleep!).

- Infants may show "avoidance behaviours", such as head turning, spitting out food or crying, at the sight of food or feeding equipment if they have had bad feeding experiences in the past, or if feeding is associated with distress. Remember if they have learned this behaviour because of unpleasant associations, they can UNLEARN it if they start to have the sort of positive feeding experiences described above.

The older infant and toddler – food refusal
Parents frequently report that their infants or toddlers will not
try new foods and that their diet is limited. It is important that parents know that a ‘fear’ of new tastes or textures is quite natural. Rejection of new foods can be reduced by small but repeated experience with them. Small quantities should be given regularly without forcing the child to take it but the child should receive lots of praise and attention etc. if he/she tries the food. It is not a good idea to mix a disliked food with one already accepted as the child then tends to refuse the food previously accepted as well!

Refusal to eat and possibly associated failure to thrive can arise in infancy and childhood for a number of different reasons. Helping children with these feeding difficulties, to begin to eat or increase their oral intake, does not happen overnight but requires limitless time and patience. Small meals can be attempted every few hours to help improve routine and appetite. Foods that are known to be preferred should be offered initially to help the child and adult experience successful eating experiences. Feeding should never be forceful, but carried out in a positive relaxed atmosphere. Do NOT draw attention to or criticise NOT EATING - in fact this only reinforces not eating. Rather, give lots of attention and praise when the child DOES eat - no matter how small. The environment should have few distractions and be consistent (i.e. regular acceptable place such as kitchen or dining room, not dictated by child such as bathroom or on the stairs!).

It is also not a good idea to reward the eating of food with a sweet or preferred dessert. The emphasis should be on mealtimes as positive and pleasant and rewarding in themselves. If eating dinner is rewarded by dessert or chocolate, the value of the actual dinner food becomes very small. Chocolate and desserts can of course be offered but as part of routine meals - not as rewards.
Summary

All infants pass through different stages in their feeding behaviours. Physical illness including congenital heart disease, neurodevelopmental conditions etc. throws up different hurdles and challenges to this natural process and these have been described in this chapter, together with some ways to help you overcome them.

Advice for Parents

• Be sensitive to your baby's signals. Start to notice how your baby shows that s/he is ready for a feed, the best times of day, what helps your baby have a good feed and how they signal to you that they need to pause or indeed stop feeding altogether.

• AVOID - force-feeding and excessive coaxing, stress and tension in yourself during a feed, giving lots of attention and reinforcement when the infant doesn’t eat etc.

• AIM for - a relaxed and pleasant atmosphere during feeding, consistent feeding signals from yourself (positioning, lullaby, rhyme etc.), rewarding feeding conditions for your baby (attention, eye contact, smiles especially when food accepted). Feeding your baby should be a pleasant experience, never a battleground.

Finally, it is important to remember that different things work for different babies. We hope the information in this chapter proves to be useful, and you may get other information and advice from other sources. However, as the person who knows your baby best, you will come to know what works best for him or her.

Source: The CHIP project, 2000 RBHSC

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Introduction to Case Studies

Aim
The purpose of the workshop is to introduce you to common feeding and nutrition problems in infants and children. Working through the cases should enable you to identify the priorities for the child, develop a management plan and be able to advise parents appropriately.

Introductory Meeting
An introductory meeting will be scheduled for medical and nursing students (where available). Students will be introduced to one another, assigned to small interprofessional groups and have the opportunity to select a case study to prepare for the workshop. Students may select one of the 10 cases available in the infant feeding pack or may base their presentation on a feeding problem from their clinical attachment. On this occasion you will be advised of the date for the infant feeding workshops.

About the workshop
Students will be expected to answer the questions related to the case scenario (see infant feeding pack) and prepare a 10 min presentation, with questions to follow. Presentations will take place over one or two workshops each lasting 1½-2 hours. The student groups will deliver their own presentations in each workshop, with the remainder of the group in attendance.

You are encouraged to be both innovative and creative in your presentation. You may use a variety of presentation aids including:

- PowerPoint
- Flipcharts
- Props
- Role play
- Other resources you consider appropriate

You are advised to spend approximately 3-4 hrs researching the case study, answering the questions, meeting with your group and preparing the presentation.

Skills Development
In the preparation and presentation of the case scenario, medical and nursing tutors will be looking for evidence of:

- Core knowledge of infant feeding and nutrition
- Teamwork
- Communication with parents and other professionals
- Appreciation of skills and competencies of other members of the healthcare team
- Ability to complete relevant growth charts
Case Study 1: Amy

Amy is a 2 year old child who has been referred to a Paediatric Out Patients clinic. Her parents are concerned that she has been unwell over the past year, has very poor energy and decreased appetite. There were no previous concerns.

Birth weight 3.4kg and weight at 8 months was 8kg. She now weighs 9.5kg. Examination – wasted buttocks and distended abdomen.

As a group:

1. Plot Amy’s growth – describe grown pattern.
2. List differential diagnoses and investigations (in order of priority).
3. The most likely diagnosis is coeliac disease. Explain this condition to Amy’s parents, including management plan.
Case Study 2: Barry

Barry is 4 months old. He has an older brother aged 1 year and 9 months and both live with their mum on the fifth floor of rented accommodation. Dad lived with the family for a month after Barry was born but moved out as he found the children hard to listen to. He visits occasionally but only stays for a short time.

Barry has been admitted with a history of poor feeding and irritability. Mum states that Barry is a slow feeder and most of the time he is not hungry even though he cries a lot. He prefers to be fed with his bottle propped up on a cushion. He was a normal healthy baby and his birth weight was 3500g. Barry now weighs 5500g.

In hospital, nurses report he is difficult to feed. He takes about 100ml every 3-4 hours, but often cries after feeds.

As a group discuss the following:

1. What are the nutritional requirements of a four month old baby?
2. How should Barry’s feeding be assessed?
4. Additional Issues:
   - describe the role of various professions in caring for this child.
   - highlight the importance of interprofessional collaboration.
   - what is the significance of working in partnership with child’s parents?

Barry has been readmitted 4 weeks following discharge having been off his feeds and frequently vomiting. Mother feels that he now has no interest in his bottle and takes a long time for him to take even a small amount of formula.

On readmission Barry’s weight is 5400g. He is very lethargic and is very irritable.

Discuss the future care and investigations that may be necessary.
Case Study 3: Jack

Jack is 13 months old. His parents have reported to their Health Visitor that he will not eat much solid food. He remains on 6 x 7 fl oz bottles of C&G Plus Formula per day. Mum reports Jack to look pale and to be a ‘cross child’.

Weight: 11kg
Length: 77cm

<table>
<thead>
<tr>
<th>Reported dietary intake:</th>
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<tbody>
<tr>
<td>7.30am:</td>
<td>9 fl oz C&amp;G (bottle)</td>
</tr>
<tr>
<td>10am:</td>
<td>9 fl oz C&amp;G (bottle)</td>
</tr>
<tr>
<td><strong>Sleeps: 10.30am - 12noon</strong></td>
<td></td>
</tr>
<tr>
<td>12.30 – 1.00pm</td>
<td>¼ slice toast</td>
</tr>
<tr>
<td></td>
<td>small amount of boiled egg</td>
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<tr>
<td></td>
<td>1 Petit Filous</td>
</tr>
<tr>
<td></td>
<td>9 fl oz diluting juice (bottle)</td>
</tr>
<tr>
<td>3.00pm</td>
<td>½ digestive biscuit</td>
</tr>
<tr>
<td>5-6pm</td>
<td>2 teaspoons potato</td>
</tr>
<tr>
<td></td>
<td>9 fl oz C&amp;G Plus (bottle)</td>
</tr>
<tr>
<td>9.30pm</td>
<td>9 fl oz C&amp;G Plus (bottle)</td>
</tr>
<tr>
<td>10pm</td>
<td>BED</td>
</tr>
<tr>
<td>3am</td>
<td>9 fl oz C&amp;G Plus (bottle)</td>
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</tbody>
</table>

As a group:

1. Calculate Jack’s nutritional requirements.
2. Estimate Jack’s current nutritional intake and compare with recommendations for a 13 month old child.
3. What other assessments should be performed?
4. Plot Jack’s height and weight on centile charts and discuss.
5. What advice would you give to Jack’s parents?
6. What other nutritional risks would you consider?
7. What other health professionals should be involved and what would be their role?
Case Study 4: Molly

Molly is now aged 5 months. She was born at term weighing 3.7kg. Molly is breastfeeding on demand, 2-3 hourly. Her current weight is 6.5kg.

She has been referred to the Rapid Response Clinic with a history of vomiting after feeds. She is otherwise well, but is thought to have gastro-oesophageal reflux.

As a group:

1. Calculate Molly’s nutritional and fluid requirements with emphasis on the role of the various healthcare professionals.

2. Assess Molly’s feeding and nutrition.

3. Explain gastro-oesophageal reflux to Molly’s mother and what management is advised.
Case Study 5: Patrick

Patrick is now 7 months old and weighing 6kgs. He was admitted to the children’s ward with a two-day history of being lethargic, reluctant to eat solids, recurrent vomiting and poor weight gain. Initially Patrick was breastfeeding well but now is only sucking for a short time. He appears to be in pain and his mum has noticed blood-stained secretions on his cot sheet.

Patrick’s mum states she is a vegetarian and has also indicated that Patrick’s older sister is being followed-up at the paediatric clinic with faltering growth / ‘non-organic failure to thrive’.

As a group, discuss the following feeding issues:

1. Assess and plan immediate management of Patrick on admission to children’s ward.

2. Discuss breastfeeding in relation to mother’s diet and take weaning into consideration.

3. Assess the monitoring of Patrick’s growth with reference to the new infant growth charts.

4. Identify any specific requirements when planning discharge into the community.

* Please support discussion with reference to literature.
Case Study 6: Niall

Niall is 18 months old. He is the first child of two ‘older’ parents. The pregnancy was uneventful, but at birth he was ‘slow to breathe’ and required ventilatory support in neonatal intensive care for several days. During the first year of life he was diagnosed as having cerebral palsy and also developed epilepsy (seizures well controlled on valproate). Feeding has always been difficult with weight gain along or just below 0.4 centile (see growth chart).

Over the past 3-4 months he has had recurrent ‘chest infections’ which put him off feeding. He also has frequent episodes of vomiting, although his parents cannot identify any triggers or pattern.

As a group, discuss the following issues in relation to feeding:

1. Niall’s diagnosis of cerebral palsy and development of epilepsy.

2. Explore feeding difficulties, alternative feeding methods and identify multidisciplinary management.

3. Highlight the significance of working in partnership with Niall’s parents with regard to possible feeding issues.
Case Study 7: Sarah

Sarah, who is 3 months old, is the youngest of six siblings. All children live at home with their parents. Sarah’s parents are almost 40 years old and Sarah was a planned baby.

Sarah has been in hospital for 2 of her 3 months. She has a Congenital Heart Defect and Downs Syndrome. Both conditions were diagnosed postnatally in day 1 and 4 of life. She has had open heart surgery and is now recovering post surgery on children’s ward. Physical recovery has been good but significant feeding difficulties exist. She was very weak pre-surgery and had been nasogastric tube fed for 6 weeks.

She refuses bottle feeds given by mum but may take for others (nursing staff; 16 year old brother). Mum breastfed her other children and was keen to breastfeed this child, but advised to stop in the weeks after Sarah’s birth as it was difficult to monitor fluid intake.

There are significant concerns about maternal mood and volume taken by baby. If intake does not improve in the next few days a nasogastric tube will be passed again. The feeding difficulties are delaying Sarah’s return home.

As a group:

1. Discuss the issues that may be impacting on Sarah’s feeding such as maternal infant bonding/attachment.

2. Explore Sarah’s nutritional requirements and the problems that may present for Sarah with a Heart Defect and Downs Syndrome.

3. Discuss the problems with reestablishment of oral feeding and identify specific roles within the multidisciplinary team at this time.
Lelia, a member of the Portuguese community is now 4 years old and living in Northern Ireland. She was born at term, birth weight 6lbs 5ozs. Following birth, Lelia was very slow to feed and gain weight and at six weeks weighed 3.5kgs. She was also hypotonic and following investigations Lelia has been diagnosed as Prader Willi syndrome. She had supplementary nasogastric feeding until 1 year of age, but remained slow to feed over the next year.

Weight:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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<tr>
<td>1 year</td>
<td>6.14kgs</td>
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<tr>
<td>2 years</td>
<td>8.2kgs</td>
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<tr>
<td>3 years</td>
<td>11kgs</td>
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<tr>
<td>3 years 6 months</td>
<td>15.5kgs</td>
</tr>
<tr>
<td>3 years 8 months</td>
<td>16.4kgs</td>
</tr>
</tbody>
</table>

24 Hour Dietary Recall (Lelia aged 3 years 6 months)

<table>
<thead>
<tr>
<th>Time</th>
<th>Meal Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morning</td>
<td>2 Weetabix/porridge/shredded wheat with semi-skimmed milk</td>
</tr>
<tr>
<td>Mid Morning</td>
<td>Toast with butter, juice</td>
</tr>
<tr>
<td></td>
<td>Banana/Fruitini</td>
</tr>
<tr>
<td>Lunch</td>
<td>Tinned beans with sausages</td>
</tr>
<tr>
<td></td>
<td>McCain spicy potatoes</td>
</tr>
<tr>
<td></td>
<td>Petit Filous</td>
</tr>
<tr>
<td>Mid Afternoon</td>
<td>Banana</td>
</tr>
<tr>
<td></td>
<td>Cup of milk (approximately 200ml)</td>
</tr>
<tr>
<td>Dinner</td>
<td>Roast potatoes (3 small), peas and 2 fish fingers (fried)</td>
</tr>
<tr>
<td></td>
<td>Ice-cream</td>
</tr>
<tr>
<td></td>
<td>Petit Filous/Muller rice</td>
</tr>
<tr>
<td>Before Bed</td>
<td>Biscuit (Heinz Weight Watchers)</td>
</tr>
<tr>
<td></td>
<td>Cup of milk (approximately 200ml)</td>
</tr>
</tbody>
</table>

As a group:

1. Comment on patterns of growth in early infancy.
2. Analyse 24 hour dietary recall.
3. Discuss feeding difficulties/behaviour from not feeding to overfeeding in relation to Prader Willi syndrome.
4. Explore ongoing management of Lelia’s nutrition and parental support.
Case Study 9: Ava

Ava is now 3 months old. She was 3kg at birth but has been vomiting since day 1. She was initially fed on SMA Gold but changed to Infasoy on advice of a friend. Vomiting continued so she was advised by Health Visitor to try Enfamil AR. She then developed loose stools so GP changed her to SMA Lactose Free with Carabel as thickener. She has continued to vomit and GP has referred her to the Feeding Clinic as mother thinks she is a hungry baby and needs to start spoon feeds. Otherwise, she is a content baby who is reaching her milestones. Weight 6.5kg.

As a group:

1. Discuss ‘milks’ used to date – indications for use.

2. Discuss the management of a baby with a history of persistent vomiting.

3. Provide appropriate feeding advice for 3 month old baby.
Case Study 10: Conor

Conor is a first baby. Normal delivery at term, birth weight 4.0kg. He is now 2½ weeks old. His mother is concerned that the jaundice which appeared on day 2 is still present. He wants to feed every 2 hours but often falls asleep during breastfeeds. Weight today is 4kg. Bilirubin levels are 200 (direct 18).

As a group:

1. Seek additional information from the mother.

2. Plot and discuss growth measurements.

3. Provide advice to mother regarding further management.

4. What is most likely diagnosis?
Case Study 11: Holly

Holly is 2 weeks old. She was born full term, healthy and weighed 3.7kg. Mum was keen to breastfeed and on day 7 of life she was feeding on demand for approximately 5-10 minutes on each breast.

Holly was weighed at 1 month and her weight was 4.1kg. She was still demand feeding and appeared content and happy, but the Health Visitor was concerned that Holly wasn’t gaining enough weight and she suggested a top-up of formula milk.

Mum introduced alternate feeds of SMA Gold. Holly’s weight at 2 months was 5.5kg. At 3 months breastfeeding was discontinued and all feeds were SMA Gold.

As a group:

1. Discuss the benefits of breastfeeding.

2. Highlight the problems of using formula to supplement breastfeeding.

3. How would you have managed this case differently?
## WHEY DOMINANT MILKS

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Breastmilk</th>
<th>Milupa Aptamil First</th>
<th>Cow &amp; Gate Premium</th>
<th>SMA Gold</th>
<th>Farley’s First Milk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy (Kcal/ml)</td>
<td>70</td>
<td>67</td>
<td>67</td>
<td>67</td>
<td>68</td>
</tr>
<tr>
<td>Protein/100mls</td>
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<td>60%</td>
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<tr>
<td>Protein % Casein</td>
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<td>40%</td>
<td>40%</td>
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<td>40%</td>
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<tr>
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<td>100% lactose</td>
<td>100% lactose</td>
<td>100% lactose</td>
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<td>√</td>
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<td>√ AA VDHA</td>
<td>√ AA VDHA</td>
<td>√ AA VDHA</td>
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<td>√ betacarotene V selenium</td>
<td>√ betacarotene V selenium</td>
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<td>X selenium</td>
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<td>Vitamins &amp; Minerals</td>
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</table>

Aptamil Infant Milk Comparison Chart (01/08). Available from http://www.aptamil4hcps.co.uk
### CASEIN DOMINANT MILKS

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Milupa Aptamil Extra</th>
<th>Milupa Milumil</th>
<th>Cow &amp; Gate Plus</th>
<th>SMA White</th>
<th>Farley’s Second Milk</th>
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</thead>
<tbody>
<tr>
<td>Energy (Kcal/ml)</td>
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<td>20%</td>
<td>20%</td>
<td>20%</td>
<td>20%</td>
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<td>Protein % Casein</td>
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<td>80%</td>
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<td>80% lactose 20% glucose syrup</td>
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<td>100% lactose</td>
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<tr>
<td>Vitamins &amp; Minerals</td>
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<td>Added at levels to meet infant requirements</td>
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Aptamil Infant Milk Comparison Chart (01/08). Available from http://www.aptamil4hcps.co.uk
# PRE TERM MILKS

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Breastmilk</th>
<th>Pre-Aptamil</th>
<th>Nutriprem 1</th>
<th>SMA Goldprem</th>
<th>Pre Nan</th>
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<tr>
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<th>SMA Progress</th>
<th>Farley’s Follow on Milk</th>
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<td>Protein % Casein</td>
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<td>Added at levels to meet infant requirements</td>
<td>Added at levels to meet infant requirements</td>
<td>Added at levels to meet infant requirements</td>
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Aptamil Infant Milk Comparison Chart (01/08) Available from http://www.aptamil4hcps.co.uk
## Dietary Reference Values

<table>
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<th>Age</th>
<th>Weight</th>
<th>Fluid</th>
<th>Energy (EAR)</th>
<th>RNI Protein</th>
<th>Sodium</th>
<th>Potassium</th>
<th>Vitamin</th>
<th>Calcium</th>
<th>Iron</th>
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<tbody>
<tr>
<td></td>
<td>kg</td>
<td>ml/kg</td>
<td>kJ/day</td>
<td>g/day</td>
<td>mmol/ day</td>
<td>mmol/ kg/day</td>
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<td>mmol/day</td>
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<td>70</td>
<td>-</td>
<td>40</td>
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</table>

**EAR:** Estimated Average Requirement  
**RNI:** Reference Nutrient Intake


### Portion Sizes for Different Age Groups

<table>
<thead>
<tr>
<th></th>
<th>1 year</th>
<th>2 – 3 years</th>
<th>3 – 5 years</th>
<th>10 years</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Meal Pattern</strong></td>
<td>3 small meals and 3 snacks plus milk</td>
<td>3 meals and 2 – 3 snacks or milky drinks</td>
<td>3 meals and 1 – 2 snacks or milky drinks</td>
<td>3 meals and 1 – 2 snacks or milky drinks</td>
</tr>
<tr>
<td><strong>Meat, fish etc</strong></td>
<td>½ - 1 tbsp (15 – 25g) minced/finely chopped, with gravy/sauce, ½ - 1 hard cooked egg</td>
<td>1 ½ tbsp (20 – 30g) chopped; 1 fish finger; 1 sausage; 1 egg</td>
<td>2 – 3 tbsp (40 – 80g); 1 – 2 fish fingers/sausages</td>
<td>90 – 120g meat; 3 – 4 fish fingers/sausages; 2 eggs</td>
</tr>
<tr>
<td>Cheese</td>
<td>20g grated</td>
<td>25 – 30g cubed or grated</td>
<td>30 – 40g</td>
<td>50 – 60g</td>
</tr>
<tr>
<td>Potato</td>
<td>1 tbsp (30g) mashed</td>
<td>1-2 tbsp (30 – 60g); 6 smallish chips</td>
<td>2 – 3 tbsp (60 – 80g); 8 – 10 chips</td>
<td>4 – 6 tbsp (100 – 180g); 100 – 150g chips</td>
</tr>
<tr>
<td>Vegetables</td>
<td>1 tbsp (30g) soft or mashed</td>
<td>1 – 2 tbsp (30 – 60g) or small chopped salad</td>
<td>2 – 3 tbsp (60 – 80g)</td>
<td>3 – 4 tbsp (100 – 120g)</td>
</tr>
<tr>
<td>Fruit</td>
<td>½ - 1 piece (40 – 80g)</td>
<td>1 piece (80 – 100g)</td>
<td>1 piece (100g)</td>
<td>1 piece (100g)</td>
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<tr>
<td>Dessert (e.g. custard/yoghurt)</td>
<td>2 tbsp (60g)</td>
<td>2 – 3 tbsp (60 – 80g)</td>
<td>4 tbsp (120g); 1 carton yoghurt (150g)</td>
<td>6 tbsp (180g)</td>
</tr>
<tr>
<td>Bread</td>
<td>½ - 1 slice (20 – 30g)</td>
<td>1 large slice (40g)</td>
<td>1 – 2 large slices (40 – 80g)</td>
<td>2 – 4 large slices (80 – 160g)</td>
</tr>
<tr>
<td>Breakfast Cereal</td>
<td>1 tbsp (15g); ½ Weetabix</td>
<td>1 – 1 ½ tbsp (15 – 20g); 1 Weetabix</td>
<td>2 – 3 tbsp (20 – 30g); 1 Weetabix</td>
<td>3 – 4 tbsp (30 – 40g); 2 Weetabix</td>
</tr>
<tr>
<td>Drinks</td>
<td>½ teacup (100mls)</td>
<td>1 teacup (150mls)</td>
<td>1 teacup (150mls)</td>
<td>1 mug (200mls)</td>
</tr>
<tr>
<td>Milk</td>
<td>500mls whole milk/day</td>
<td>350mls whole or semi-skimmed milk/day</td>
<td>350mls whole or semi-skimmed milk/day</td>
<td>350mls whole, semi-skimmed or skimmed milk/day</td>
</tr>
</tbody>
</table>

For children in all age groups: aim for 6 – 8 drinks per day, including milky drink

# General Guide to Oral Requirements in Sick Children

<table>
<thead>
<tr>
<th>Infants 0-1 year old (based on actual weight, not expected weight)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Energy</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
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<td><strong>Potassium</strong></td>
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How to confirm the correct position of nasogastric feeding tubes in infants, children and adults

This information does NOT apply to neonates (preterm to 28 days)

Nasogastric tube feeding is common practice and thousands of tubes are inserted daily without incident. However, there is a small risk that the tube can become misplaced into the lungs during insertion, or move out of the stomach at a later stage. Studies have shown that conventional methods to check the placement of nasogastric feeding tubes can be inaccurate. The National Patient Safety Agency (NPSA) has put together this information to advise staff which methods should and should not be used to check the position of nasogastric feeding tubes.

Note that this information does not replace clinical judgement. Local written policies may vary slightly as long as they do not fall below the standards set out in this document.

**Testing the position of nasogastric feeding tubes**

**Methods that should be used:**
- measuring the pH of aspirate using pH indicator strips/paper;
- radiography.

**Methods that should NOT be used:**
- auscultation of air insufflated through the feeding tube (‘whoosh’ test);
- testing the acidity/alkalinity of aspirate using blue litmus paper;
- interpreting absence of respiratory distress as an indicator of correct positioning;
- monitoring bubbling at the end of the tube;
- observing the appearance of feeding tube aspirate.

**What are the limitations of pH testing and radiography?**

One of the limitations with the pH testing method is that the stomach pH can be affected by, for example, medication and frequency of feeds. Additionally, gaining aspirate from the feeding tube can be difficult, particularly when using fine bore tubes. For post-operative patients where the tube has been positioned under direct vision, tube replacement or removal should only be done on the advice of the surgeon.

The most accurate method for confirming correct tube placement is radiography. However, there have been multiple reports of x-rays being misinterpreted by physicians who are not trained in radiology. Minimising the number of x-rays is also important in order to avoid increased exposure to radiation, loss of feeding time and increased handling of seriously ill patients. Outside of the acute care setting, access to radiology is difficult, particularly if the patient requires transportation from the community.

Radiography should therefore not be used ‘routinely’ and local policies are recommended for particular groups of patients, for example, those on intensive care units and neonates. Fully radio-opaque tubes that have markers to enable accurate measurement, interpretation and documentation of their position should be used.

The flowcharts attached to this document set out actions to take to: gain sufficient aspirate; what to do when pH is above 5.5; and when radiography should be considered. The table provides the rationale behind this advice. Prior to feeding each patient, a risk assessment needs to be carried out. This should balance the potential risks with the need to feed. Patients who are comatose or semi-comatose, have swallowing dysfunction or recurrent retching or vomiting, have a higher risk of placement error or migration of the tube, whereas patients on antacid medication are more likely to have pH levels of 6 and above. Actions to reduce risks and the rationale behind the actions should be documented prior to feeding. This information will support staff making the correct clinical decisions.

**What pH paper/strip should I use?**

We recommend that pH indicator strips with 0.5 gradations or paper with a range of 0 to 6 or 1 to 11 should be used. It is important that the resulting colour change on any indicator or paper is easily distinguishable, particularly between the pH 5 and 6 range.

**When should I check the tube position?**

The tube position should be checked:
- following initial insertion;
- before administering each feed;
- before giving medication (see BAPEN guidance at www.bapen.org.uk/drugs-ental.htm);
- at least once daily during continuous feeds;
- following episodes of vomiting, retching or coughing (note that the absence of coughing does not rule out misplacement or migration);
- following evidence of tube displacement (for example, loose tape or visible tube appears longer).

Ensure that all staff report misplaced feeding tube incidents through their local risk management systems. The NPSA will automatically receive this information through the National Reporting and Learning System (NRLS). This will enable both local and national monitoring of nasogastric feeding tube misplacements and inform our understanding of the problem.
The recommended procedure for checking the position of nasogastric feeding tubes in infants, children and adults

<table>
<thead>
<tr>
<th>Action</th>
<th>Rationale</th>
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<tbody>
<tr>
<td>Check whether the patient is on medication that may increase the pH level of gastric contents</td>
<td>Medication that could elevate the pH level of gastric contents are; antacids, H₂ antagonists and proton pump inhibitors. For those patients who are regularly on antacids, the initial risk assessment needs to identify actions that staff should take in this scenario, and document them in the care plan. The initial pH of the aspirate should also be documented in the case notes.</td>
</tr>
<tr>
<td>Check for signs of tube displacement</td>
<td>Documenting the external length of the tube initially and checking external markings prior to feeding will help to determine if the tube has moved. The documentation will also assist radiographers if an x-ray is needed.</td>
</tr>
<tr>
<td>Sufficient aspirate (0.5 to 1ml) obtained</td>
<td>0.5 to 1ml of aspirate will cover an adequate area on the single, double or triple reagent panels of pH testing strips/paper. Allow ten seconds for any colour change to occur.</td>
</tr>
<tr>
<td>Aspirate is pH 5.5 or below</td>
<td>Commence feed. There are no known reports of pulmonary aspirates at or below this figure. The range of pH 0 to 5.5 balances the risk between increasing the potential problems for clinical staff e.g. removing tubes that are actually in the stomach, increased use of x-ray with the as yet, unreported possibility of feeding at pH 5.5 when the tube is in the respiratory tract.</td>
</tr>
<tr>
<td>Aspirate is pH 6 or above</td>
<td><strong>DO NOT FEED.</strong> Possible bronchial secretion; leave up to one hour and try again. The initial risk assessment should identify actions for staff to take in this scenario for each patient. The actions should be documented in the care plan and/or in local policies. If there is ANY doubt about the position and/or the clarity of the colour change on the pH indicator strip/paper, particularly between the ranges pH 5 and 6, then feeding should NOT commence – seek advice.</td>
</tr>
<tr>
<td>Wait up to one hour before re-aspirating to check pH level</td>
<td>The most likely reason for failure to obtain gastric aspirate below pH of 5.5 is the dilution of gastric acid by enteral feed. Waiting for up to an hour will allow time for the stomach to empty and the pH to fall. The time interval will depend on the clinical need of the patient and whether or not they are on continuous or bolus feeds.</td>
</tr>
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</table>

**Problems obtaining aspirate?**

| Turn patient onto their side | This will allow the tip of the nasogastric tube to enter the gastric fluid pool. |
| Inject air (1-5ml for infants and children, 10-20ml for adults) using a 20ml or 50ml syringe. Wait for 15-30 minutes and try again | Injecting air through the tube will displace any residual fluid (feed, water or medicine) and may also dislodge the exit-port of the nasogastric feeding tube from the gastric mucosa. Using a large syringe allows gentle pressure and suction; smaller syringes may produce too much pressure and split the tube (check manufacturers guidelines). Polyurethane syringes are preferable to other syringes. It is safe practice to use nasogastric tubes and enteral syringes that have non luer connectors (Building a Safer NHS for Patients: Improving Medication Safety published 22/01/2004 available at www.dh.gov.uk) |
| Advance the tube by 1-2cm for infants and children or 10-20cm for adults | Advancing the tube may allow it to pass into the stomach if it is in the oesophagus. |
| Consider x-ray | X-ray should not be used routinely. The radiographer will need to know that this advice has been followed, what the problem has been and the reason for the request. The radiographer should document this. Fully radio-opaque tubes with markings to enable measurement, identification and documentation of their external length should be used. |
| All radiographs should be read by appropriately trained staff | |

**Additional tip**

If the patient is alert, has intact swallow and is perhaps only on supplementary feeding and is thus eating and drinking during the day, ask them to sip a coloured drink and aspirate the tube. If you get the coloured fluid back then you know the tube is in the stomach.
Confirming the correct position of nasogastric feeding tubes in **ADULTS**

1. Check if on acid inhibiting medication
2. Check for signs of tube displacement and measure tube length
3. Reposition or repass tube if required
4. Aspirate using 50ml syringe and gentle suction

Aspirate not obtained

**DO NOT FEED**
1. If possible, turn adult onto side
2. Inject 10-20ml air into the tube using syringe
3. Wait for 15-30 minutes
4. Try aspirating again

Aspirate not obtained

**DO NOT FEED**
1. Advance tube by 10-20cm
2. Try aspirating again

Aspirate not obtained

**DO NOT FEED**
1. Call for advice
2. Consider replacement/repassing of tube and/or checking position by x-ray

Aspirate obtained (0.5-1ml)

Test on pH strip or paper

- pH 6 or above
- pH 5.5 or below

**DO NOT FEED**
1. Leave for up to one hour
2. Try aspirating again

pH 6 or above
pH 5.5 or below

Proceed to feed

**CAUTION:** If there is ANY query about position and/or the clarity of the colour change on the pH strip, particularly between ranges 5 and 6, then feeding should **not** commence.

The information in this document was originally developed by the National Nurses Nutrition Group (NNNG) and further developed in collaboration with the Medicines and Healthcare products Regulatory Agency (MHRA), the National Patient Safety Agency (NPSA), NHS clinicians, risk managers and other leading experts in the field. The Patient Safety Research Programme at the University of Birmingham has commissioned additional research to assess these methods further. This advice may therefore be revised following the outcome of this work.

www.npsa.nhs.uk/advice
Confirming the correct position of nasogastric feeding tubes in INFANTS and CHILDREN

1 Check for signs of displacement and measure the tube
2 Reposition or repass tube if required
3 Aspirate using 20 or 50ml syringe and gentle suction

Aspirate not obtained

Aspirate obtained (0.5-1ml)

DO NOT FEED
1 If possible, turn infant/child onto side
2 Inject 1-5ml air into the tube using 20 or 50ml syringe
3 Wait for 15-30 minutes
4 Try aspirating again

Aspirate not obtained

Aspirate obtained (0.5-1ml)

DO NOT FEED
1 Advance tube by 1-2cm
2 Try aspirating again

Aspirate not obtained

Test on pH strip or paper

pH 6 or above
pH 5.5 or below

DO NOT FEED
1 Leave for up to one hour
2 Try aspirating again

pH 6 or above
pH 5.5 or below

DO NOT FEED
1 Call for advice
2 Consider replacement/repassing of tube and/or checking position by x-ray

Proceed to feed

CAUTION: If there is ANY query about position and/or the clarity of the colour change on the pH strip, particularly between ranges 5 and 6, then feeding should not commence.
### Additional Reading

**Breastfeeding**

### Published Documents


### Websites

- Foods Standards Agency - Independent UK government department set up to protect the public's health and consumer interests in relation to food [http://www.food.gov.uk](http://www.food.gov.uk)
- Public Health Agency for Northern Ireland [http://www.publichealth.hscni.net](http://www.publichealth.hscni.net)
- NHS Breastfeeding – information and support for parents and healthcare professionals [http://www.breastfeeding.nhs.uk](http://www.breastfeeding.nhs.uk)
- National Childbirth Trust - UK parenting charity [http://www.nctpregnancyandbabycare.com](http://www.nctpregnancyandbabycare.com)
- Sure Start - Government programme to deliver the best start in life for every child [http://www.surestart.gov.uk](http://www.surestart.gov.uk)
- Bliss – The premature baby charity for the UK [http://www.bliss.org.uk](http://www.bliss.org.uk)
- The Breastfeeding Network – provides support information for breastfeeding women and for those involved in their care [http://www.breastfeedingnetwork.org.uk](http://www.breastfeedingnetwork.org.uk)
- Breastfeeding Support Groups in Northern Ireland [http://www.breastfeedingcommunity.co.uk/Interactivemap/northern_ireland.htm](http://www.breastfeedingcommunity.co.uk/Interactivemap/northern_ireland.htm)
- La Leche League – world-wide organisation of mother-to-mother support groups as well as outreach programmes [http://www.laleche.org.uk](http://www.laleche.org.uk)
- Association of Breastfeeding Mothers - charity run by mothers for mothers [http://www.abm.me.uk](http://www.abm.me.uk)
Weaning and infant feeding in the first 12 months of life

**Published Documents**


**Websites**

Scientific Advisory Committee on Nutrition (SACN)
http://www.sacn.gov.uk

British Dietetic Association
www.bda.uk.com/publications.statements
## Infant Formula Milk

### Published Documents


### Websites

Infant Formula Companies
- http://www.aptamil.co.uk
- http://www.cowandgate.co.uk
- http://www.in-practice.co.uk
  (Cow and Gate’s practical support for healthcare professionals)
- http://www.heinzbaby.co.uk.nurture
- http://www.hipp.co.uk
- http://www.smanutrition.co.uk

## Gastro-Oesophageal Reflux in Infants and Children

### Published Documents


## Failure To Thrive

### Published Documents


## Feeding Difficulties

### Published Documents


## Iron Deficiency Anaemia

**Published Documents**

Daly, A., *et al.* (1996) Prevention of anaemia in inner city toddlers by an iron supplemented cow’s milk formula. *Archives of Disease in Childhood, 75*, 9-16


## Recognising Malnutrition

**Published Documents**


## Enteral Feeding

**Published Documents**


**Websites**

Northern Ireland Adverse Incident Centre (NIAIC)
http://www.dhsspsni.gov.uk/niaic

## Food Allergy and Food Intolerances

**Published Documents**


### Coeliac Disease

#### Published Documents

British Society of Gastroenterology. Guidelines for the Management of patients with Coeliac Disease.

These guidelines are currently under review. New BSG guidelines will be published when available. In the meantime please refer to the NICE guidance published in May 2009. Available from: http://guidance.nice.org.uk/CG86

#### Websites

British Society of Gastroenterology  
http://www.bsg.org.uk

### Phenylketonuria (PKU)

#### Websites

National Society for Phenylketonuria  
http://www.nspku.org  
http://www.nhs.uk/Conditions/Phenylketonuria/Pages/Introduction.aspx

### Childhood Obesity

#### Published Documents

Available from: http://www.nice.org.uk

#### Websites

The Royal College of Paediatrics and Child Health  
http://www.rcpch.ac.uk  
Preventing childhood obesity  
http://www.bma.org.uk/ap.nsf/content/ChildhoodObesity  
http://www.mendprogramme.org

### Soy Proteins

#### Published Documents

### Maternal Mood

**Published Documents**


### Impact of Chronic Illness

**Published Documents**


**Websites**

Children’s Heart Federation
http://www.childrens-heart-fed.org.uk/feeding

### Growth Charts

**Published Documents**


**Websites**

http://www.healthforallchildren.co.uk
http://www.childgrowthfoundation.org

### Interprofessional Education

**Published Documents**


Please score each group from 1 to 5 (1=poor; 5=excellent)

<table>
<thead>
<tr>
<th>PRESENTATION</th>
<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
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<td>• Clear explanation of problem and appropriate management by the multidisciplinary team</td>
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<td>• Information presented in logical order</td>
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<td>• Summary/conclusion provided</td>
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<td>DELIVERY</td>
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<td>• Presentation clear and audible</td>
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<td>• Presenters engaged with audience</td>
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<td>• Good use of audio/visual aids</td>
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<td>• Presentation within time limit</td>
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<td>LEARNING EXPERIENCE</td>
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<td>• Presentation provided accurate information on the management of the scenario with relevant application to future clinical practice</td>
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