Objectives:

Following completion of this module you will be able to:

1. Describe the anatomy of the lactating breast.
2. Identify and teach correct breastfeeding positioning and attachment.
3. Describe the main hormonal influences on breastfeeding.
4. Discuss the normal feeding pattern and behaviour of the newborn.
5. Identify tools that assess breastfeeding adequacy.
6. Discuss maternal lactation nutrition requirements.
7. Discuss common myths associated with breastfeeding.

Breast milk overview

Breast milk is a complex living substance and is nutritionally complete for babies until six months of age. (1)

No formula product can exactly replicate breast milk. (2)

Colostrum, the secretion produced in the first few days after birth, is nutrient-rich, contains essential proteins, vitamins, enzymes, growth factors, antibodies and non-pathogenic bacteria to protect against illness. (3)

Colostrum gradually changes into mature milk during the first one to two weeks after birth. There are lower concentrations of fat in colostrum than in mature milk but higher concentrations of protein and minerals. (3)
The composition of breast milk varies between individuals, depending on diet and stages of lactation. (3)

Breast milk’s complex biochemistry means that it changes from morning to night and even over the course of a feed. (3)

The milk first ingested by a baby during a feed has a lower fat content, which steadily increases until the feeling of ‘satiety’ is reached. (3)

Click the link to view a table showing composition comparisons between mature human milk and infant formula.

Ultrasound technology has changed the perceived anatomy of the lactating breast. (4)

The new picture of the anatomy of the breast will help breastfeeding mothers gain a better understanding of how their breasts work. See figure 1. (4)

The number of milk ducts in the breast is less than previously believed. Breast size modification surgery will have to take this into account, since the loss of only a few ducts can seriously compromise a woman's ability to breastfeed. (4)

Findings suggest an uneven distribution of milk glands, the absence of lactiferous sinuses, and the high variability in the number of milk ducts between individuals. (4)

Studies also show that a rapid first milk ejection is important for efficient milk removal. (4)

These new findings identify the need for mothers to consider their own particular anatomy when deciding how to use their hands to support their breasts during breastfeeding or manual expression.
Lactogenesis I

- Is when the mammary glands develop the ability to secrete milk components during the 2nd trimester of pregnancy.
- Increased lactose secretion within the breast increases the concentration of prolactin in the blood.

Lactogenesis II

- Is the onset of copious milk secretion from 24 to 102 hours following birth. (5)
- Is triggered by the withdrawal of progesterone following birth.

Milk volume

- The average amount of colostrum consumed at the first breastfeed is 0-5ml. (5)
- 7-123mls of colostrum, however on average 30-40mls is consumed in the first 24 hours.
- From 2 - 6 days after birth the average milk intake is 395 - 868mls per day.
- By 1 month of age average milk intake is 750-800 ml per day.
- Milk production on day 6 is significantly associated with milk production at week 8.
Established lactation

- From 1 to 6 months of age during exclusive breastfeeding milk production is stable at 710ml-803ml per day.
- Not all babies take the same amount of milk. Intake varies from 440 to more than 1220ml per day.
- The growth rate of breastfed babies is related to the total amount of milk they consume rather than fat, protein or lactose concentrations.
- Exclusively breastfeeding storage capacities range from 81- 606mls (the baby of a mother with a small milk storage capacity may feed more frequently).
- On average babies take 67% of milk available in the breast.
- Breastfed babies feed according to appetite and do not stop feeding because the breast is empty.
- The left and right breasts rarely produce the same amount of milk (babies may prefer 1 breast to the other).

Remember:

- Milk production and secretion are under endocrine and autocrine control.
- When the infant sucks at the breast, receptors are stimulated, resulting in the release of oxytocin and prolactin.
- Milk synthesis is related to the rate at which the breast is drained.
Prolactin

When the baby suckles, prolactin blood levels rise stimulating milk production in the alveoli.

The prolactin level is highest approximately 30 minutes after the beginning of a feed (production for next feed).

In the first few weeks the more the baby suckles and stimulates the breast the more prolactin is released = increased milk production.

Oxytocin

Oxytocin causes the myoepithelial cells around the breast alveoli to contract.

Milk is then forced into the ducts towards the nipple.

This reflex is known as the "letdown" or milk ejection reflex.
Feedback inhibitor of lactation (FIL)

- milk production is also controlled by a polypeptide found in breast milk. (6)
- it allows the localised control of milk production (independent in each breast).
- if milk is not removed, the inhibitor accumulates, stopping further milk production.
- if milk is removed, the inhibitor is also removed allowing milk production to resume.
- increases the importance of expressing breast milk if the baby is unable to breastfeed.
- FIL enables the amount of milk produced to be determined by how much the baby takes and therefore how much the baby needs.

To breastfeed effectively the baby must coordinate the processes of sucking, swallowing and breathing. (7)

Sucking

Measurments of infant sucking and tongue movements using ultrasound imaging have found:

- The nipple does not reach the junction of the hard and soft palate, but rather comes within 1.3-6.9mm of the junction. (8) This creates a vacuum space between the end of the nipple and soft palate for milk to collect.
- The tongue does not compress the nipple (it retains it's basic shape) or move in a peristaltic movement. The anterior portion of the tongue remains flat. (9)
- At the start of the suck cycle the tongue is up, creating a baseline vacuum causing milk to be "sucked" into the vacuum. (9)
- When the peak vacuum is reached (a bolus of milk is in this space) the tongue moves down (nipple expands) and the milk is propelled towards the pharynx.
- The cycle ends with the tongue down and a return to baseline vacuum.
Understanding Breastfeeding

Sucking

The creation of the vacuum by the baby at the breast is the key to milk removal. When the tongue is down the vacuum is at the maximum level and the milk flows. Babies who cannot create this vacuum will not have an adequate milk intake (e.g. preterm, near term, cleft palate, poor/weak suck).

Swallowing

Swallowing is a complex sensorimotor activity consisting of 3 phases:

1. Oral
2. Pharyngeal
3. Oesophageal

It involves:

- The oral bolus being delivered to the pharynx during each suck cycle.
- Usually 1 or 2 suck cycles to accumulate enough milk in the pharynx to trigger a swallow.
- The protection of the airway by the vocal cords and the epiglottis.
- The short cessation of respiration during a swallow.
- Cricopharyngeal relaxation, peristalsis of the oesophagus facilitating passage of the bolus to the stomach.
Understanding Breastfeeding

Breathing

- Differences in the duration of inspiration and expiration have been found between breastfed and bottle fed infants. (9)
- Respiratory rate is slower during nutritive sucking related to the increased rate of swallowing.

Therefore when examining suck-swallow-breathe ratios the success of the breastfeeding infant depends in part on:

- The level of vacuum applied by the infant.
- The ability to alter the suck-swallow-breathe ratios to accommodate the variable flow of milk ejection. (9)

Infant Sucking Video

On the following slide a video will autoplay. This video demonstrates normal infant sucking research findings.

The video will take longer to load. Please be patient!
Correct positioning at the breast is the key to successful breastfeeding. Incorrect positioning can result in many early breastfeeding problems discussed later in this package. For attachment to occur easily, the mother and baby must be positioned correctly. Midwives should use a "hands off" approach to ensure optimal positioning and attachment.

Read the following KEMH clinical Guidelines 8.1.6 "Showing the woman how to breastfeed". (10)

Teaching new mothers the skill of positioning and attachment can promote successful initiation of breastfeeding. (11)

Preparing the mother for independent feeding involves increasing her confidence by using a "hands off" approach.

The use of visual (doll) and verbal strategies to demonstrate principles empowers mothers, improves confidence and autonomy and may have a positive effect on breastfeeding duration.

Read the following abstract supporting the implementation of the "hands off" technique. (12)
Signs of optimal attachment include:

- baby facing mother chest to chest, tummy to tummy
- more of the areola is visible above the baby's top lip than below the lower lip
- the baby's mouth is wide open
- the baby's lower lip is curled outwards
- the baby's chin is touching or almost touching the breast

Figure 4: Good attachment.

Signs of suboptimal attachment include:

- only the nipple is in the mouth not the underlying breast tissue
- the baby's tongue is not extended over the gum, an effective vacuum seal is not created
- more of the areola is visible below the baby's bottom lip than the top lip
- the baby's mouth is not wide open
- the baby's lower lip is turned inward
- the chin is away from the breast

Figure 5: Suboptimal attachment.
Techniques to maximise optimum attachment are important to ensure successful breastfeeding.

Click the following links to access information on techniques to maximise attachment.

- Biological nurturing: [click here](http://www.biologicalnurturing.com/assets/articles/Colson%202005%20PM%208%2011%2029-32.pdf)
- Optimal positions: [click here](http://www.sciencedirect.com/science/article/pii/S0378378207002423)
- Baby-led feeding: [click here](#)

baby-led link broken
Understanding Breastfeeding

Video

On the following slide a video will autoplay. This video demonstrates normal and abnormal feeding at the breast.

The video will take longer to load. Please be patient!

Breastfed babies require frequent feeds. (18)

Understanding the feed/sleep patterns of breastfed babies and the signs of a well fed baby ensure the feeding is adequate for the baby’s needs.

It is not uncommon for baby’s to demand 8-12 feeds in 24 hours. (1)
The first 2 hours following birth the baby is alert and eager providing an optimal time for the first breastfeed. (1)

The baby may then cycle through light and deep sleep for the next 18 hours.

20-24 hours following birth a second period of wakefulness occurs.

Breastfed babies often “cluster feed” (several feeds over 2-3 hours). Followed by a long period of deep sleep of around 4-5 hours. (18)

Cluster feeds continue throughout lactation and often occur during the evening (unsettled in the evening).

One or more episodes of cluster feeding throughout the day is normal.

Breastfed babies do not usually feed “routinely” e.g every 2-3 hours. Mothers may interpret cluster feeds as a sign of low supply rather than normal behaviour. (17)

Read the following link to on the “Breastfeeding dyad”.

To ensure the baby is well and allay any concerns of the mother, the baby's progress can be assessed by:

**Baby's behaviour**

- Baby is generally content following feeds (as mentioned previously episodes of unsettled behaviour and cluster feeds are normal).
- A healthy infant is alert and responsive when awake with bright eyes and firm elastic skin. (1)
- Baby demands 8-12 breastfeeds in a 24 hour period. (1)

**Urine output**

- Until the mother's supply increases the baby may not pass urine often - once or more every 24 hours is normal. (1)
- As the milk volume increases, the urine output will increase.
- 6 or more pale soaked cloth nappies in 24 hours. (1)
- Disposable nappies may mask wetness and need closer inspection to determine wetness.
- Scant, strong yellow urinations need careful assessment of breastfeeds. (1)
Bowel actions

- The first stool is meconium - greenish black.
- 24-48 hours following birth the meconium changes first to brownish "transitional stools".
- By the 3rd or 4th day loose, mustard yellow (sometimes with milk curds) although occasionally green or orange (not significant in a breastfed baby) stools.
- Frequent, runny stools do not indicate diarrhoea or lactose intolerance (evidence of sufficient milk).
- During the first few weeks babies usually have 1-2 stools at every feed.
- The assessment of bowel actions is one of the best indicators of an adequate breast milk transfer.

Weight gain

- The passage of meconium and loss of water by evaporation cause a normal initial weight loss of 5-10 percent.
- By 4-6 days of age the baby starts to regain weight.
- By 2 weeks of age the baby should have returned to his/her birth weight. (1)
- If a baby is content and healthy, minor fluctuations in weight are of little concern (may depend on the timing of weight calculation re: recent feed, stool, urination).
- Static weight or suspected weight loss over a period of several days requires a feeding assessment by a breastfeeding specialist (Lactation Consultant). (1)
- Birth to age 3 months—a gain of 150-200 grams a week.
- Age 3 to 6 months—a gain of 100-150 grams a week.
- Age 6 to 12 months—a gain of 70-90 grams a week.
Breastfeeding assessment tools provide in-depth information that allows the screening of breastfeeding dyads.  

The use or modification of published breastfeeding tools help to:

- objectively document feedings
- predict future problems
- identify mothers at risk of early breastfeeding cessation
- facilitate early corrective interventions

Read the following link that describes available breastfeeding assessment tools. Note: Access to this link requires free registration to the Medscape website. If you prefer not to register alternative sources can be found on the internet.

Link broken
The following table summarises the daily recommended serves of food:

<table>
<thead>
<tr>
<th>Category</th>
<th>Serves</th>
</tr>
</thead>
<tbody>
<tr>
<td>19–60 years</td>
<td>4-9</td>
</tr>
<tr>
<td>60+ years</td>
<td>4-7</td>
</tr>
<tr>
<td>Pregnant</td>
<td>4-6</td>
</tr>
<tr>
<td>Breastfeeding</td>
<td>5-7</td>
</tr>
</tbody>
</table>

Key points:

- It is important to consider maternal nutritional status prior to and during pregnancy.
- Mothers with inadequate diets produce nutritionally adequate breast milk.
- Fluctuations in milk composition may occur in response to dietary changes particularly in malnourished women.

The quantity and quality of breast milk is only affected in the severely malnourished mother. Breast milk of the well-nourished mother with sufficient nutrient stores will usually not be affected by diet fluctuations.
During lactation a mother’s nutritional requirements increase to cover the energy required to produce breast milk and breastfeed. (6)

**Energy requirements:**

- Increase during lactation.
- In a well nourished woman a portion of energy is derived from stores deposited during pregnancy. (20)
- Vary between individuals.
- During lactation the mother uses about 500 kilocalories (equivalent to one extra meal) each day to produce 750mls of breast milk. (5)
- Mother’s who have not layed down sufficient stores in pregnancy will require greater energy from nutrition.

**Additional Energy Requirements**

The following table summarises the energy requirements: (1)

| Table II.3 Summary of additional energy needs during lactation^a,b,c |
|---|---|---|---|---|---|
| Breastfeeding (months) | Milk volume (ml/day) | Energy cost of milk (kcal/day)^a | Energy cost of milk synthesis (kcal/day)^b | Full costs (kcal/day) |
| Exclusively | | | | |
| 0–2 | 710 | 476 | 119 | 595 | 440 |
| 3–6 | 800 | 556 | 134 | 670 | 515 |
| Partially | | | | |
| 0–5 | 660 | 442 | 111 | 553 | 398 |
| 6–8 | 590 | 395 | 99 | 494 | 339 |
| 9+ | 440 | 295 | 74 | 369 | 369 |

^a. Using 0.67 kcal.
b. Assuming 80% efficiency.
c. Assuming about 500 g/month (16.7 g/day) up to 8 months (none thereafter) at 9.3 kcal.

Diet can influence the chemical constituents of breastmilk, as studies on vitamin A and lipids have shown. The principles of the Australian Guide to Healthy Eating remain the basis of an appropriate diet. Mothers who are on very restrictive diets—vegans, for example—will need specific assessment to ensure that they are not deficient in nutrients such as vitamin B₁₂.
Protein:

- Milk protein is not associated with dietary intake. (20)

Fat:

- Total milk fat content is not affected by maternal dietary intake. (20)
- Cholesterol level in breast milk is independent of maternal intake.
- The fatty acid profile of breast milk is affected by maternal dietary intake.
- Women with low dietary fat intake utilise deposited fat to maintain milk levels.
- In women with a normal fat intake, the fatty acid profile in breast milk is reflected by the type of fats in her diet.

Vitamins:

- In malnourished women increased vitamin intake increases the breast milk vitamin composition (less so in well nourished). (20)
- Milk may contain insufficient levels of vitamin K. (vitamin K injection at birth).
- Women who are vitamin D deficient themselves need to supplement their diets to improve breast milk vitamin D levels.

Minerals:

- Are usually stable in breast milk regardless of maternal intake, except for selenium, iodine, magnesium and heavy metals.
- Iron in maternal diet or serum is not associated with the iron content in breast milk. (20)
Read the following link that describes some common Breastfeeding Myths.

Now try a Quiz covering topics from this Module.

The quiz begins on the next slide.

To advance to the next question use the button not the button on the slide. Your final score is displayed but will not be recorded.
BFHI module 3 quiz

Module 3 Quiz

Signs that indicate poor attachment of the baby to the breast include all of the following except:

- Nipple appears compressed or has a 'ridge' when baby detaches.
- Chin is pressed well into the breast.
- A small resebud gape.
- Nose pressed into the breast.

Attempts: 2

Module 3 Quiz

Which of the following statements addressing infant sucking is correct:

- The nipple reaches the junction of the hard and soft palate.
- The creation of a vacuum by the baby at the breast is the key to effective milk removal.
- The tongue pinches the nipple during sucking.
- The tongue moves in a peristaltic movement from front to back.

Attempts: 2
Module 3 Quiz

Credit: question 3 from 10

Most babies lose weight for several days following birth. At what age should the baby have regained their birthweight?

- 5 days
- 2 days
- 2 weeks
- 3 weeks

Attempts: 2

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Module 3 Quiz

Credit: question 4 from 10

When teaching the mother to breastfeed it is important to:

- Adopt a hands off approach.
- Attach the baby to the breast for her so she knows how it should feel.
- Place your finger into the baby’s mouth to assess their suck.
- Only provide instruction to those mothers who have not attended breastfeeding classes.

Attempts: 2
Understanding Breastfeeding

Module 3 Quiz

Which statement concerning maternal nutrition during lactation is correct?

- Eating more fat in the diet will increase the total fat content of breast milk.
- Eating more iron rich foods during lactation increases the level of iron in the breast milk.
- In a well-nourished woman part of the energy needed to produce breast milk is derived from stores laid down during pregnancy.
- A woman who is slightly malnourished will not produce sufficient milk for her baby.

Attempts: 2

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Understanding Breastfeeding

Module 3 Quiz

The composition of breastmilk varies between individuals, depending on diet and the stage of lactation.

- True
- False

Attempts: 1
Studies show that a rapid first milk ejection is important for effective milk removal.

- True
- False

Attempts: 1

Oxytocin causes the myoepithelial cells within the alveoli to contract.

- True
- False

Attempts: 1
Module 3 Quiz

1. It is unusual for a breastfed baby to demand 8 to 12 feeds in 24 hours.
   - True
   - False
   - Attempts: 1

2. The assessment of bowel actions is of little relevance to determine adequacy of breast milk transfer.
   - True
   - False
   - Attempts: 1
References/Acknowledgements

Module Three


2. Stockwell D. Food standards Australia, New Zealand, transcript, 13 June 2007, p 11.


10. Women and Newborn Health Service: King Edward Memorial Hospital. Clinical Guidelines, Section B; Newborn Feeding, 8.1.6 Showing the woman how to breastfeed. 2008.


**Acknowledgements**

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- Photos; http://www.mammydoula.co.uk , http://www.007b.com
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