

University of Basrah
Al-Zahraa Medical College



Ministry of Higher education
and Scientific Research

Block: child health

Lecture: nutrition

Lecturer: Dr. Miami K. Yousif

Block staff:

Dr. Jawad Ramadan (supervisor)

Dr. Miami Kadhim (leader)

Dr. Rehab Abdulwehab (co-leader)

Dr. Ahmad Jaafar (co-leader)

Dr. Ahmad Mohammad (coordinator)

Dr. Dhaighum Imad

Dr. Khalid Ahmad

Dr. Basim Abdulkareem

Dr. Haithem Hussain

Dr. Sadiq Hasan

Dr. Thura Kadhim

Dr. Ahmed Ibrahim

Dr. Dheyaa Jameel



Nelson Textbook of Pediatrics, 20th edition.

Nelson Essentials of Pediatrics, 7th Edition 2015

Pediatric Decision-Making Strategies

Illustrated Textbook of Pediatrics

Short Atlas in Pediatrics





nutrition

Learning outcomes

- LO1: Advantages of breast feeding**
- LO2: Compositional changes of BM**
- LO3: Bioactive components of BM**
- LO4: Position during BF**
- LO5: Breast feeding support**
- LO6: Complications of BF**
- LO7: Contraindications of breast feeding**
- LO8: infant formula**
- LO9: Complementary feeding**
- LO10: nutritional requirement**

Human milk and breastfeeding are the ideal and normative standards for infant feeding and nutrition. The American Academy of Pediatrics (AAP) recommends human milk as the sole source of nutrition (exclusive) for the first 6 months of life, with continued intake for the first year, and as long as desired thereafter (up to 2 years).



Hotspot: breast milk is the best

Advantages of breast feeding LO1

Breastfeeding has short- and long-term advantages for infant.

- Cognitive: BF positively associated with IQ and language
- GI: Decrease the incidence and severity of diarrhea
- Respiratory: decrease respiratory manifestations, infection, otitis media, asthma
- Boost immune system: decrease bacteremia, bacterial meningitis, and necrotizing enterocolitis.
- Atopy and eczema: decreased
- Obesity: decreased
- Possibly reduce type 1 DM, probably type2 DM and hypertension

BF advantages to the mother

Mothers who breastfeed experience both short- and long-term health benefits:

- Decreased risk of postpartum hemorrhages, more rapid uterine involution
- decreased postpartum depression.
- longer period of amenorrhea
- there is an association between a long lactation of 12 to 23 months (cumulative lactation of all pregnancies) and a significant reduction of hypertension, hyperlipidemia, cardiovascular disease, and diabetes.
- Cumulative lactation of more than 12 months also correlates with reduced risk of ovarian and breast cancer.



Hotspot: The first 2 days of breastfeeding, and perhaps the first hour of life, may determine the success of breastfeeding.

Compositional changes of BM

LO2

BM changes continuously between feeds, over time and even within single feed

- **Lactogenesis 1**..... secretion of colostrum
- **Lactogenesis 2** Secretion of transitional milk Mature milk

colostrum

- Secretion in the first 3 days
- Thick
- Highest protein
- Rich in Ig, antibodies against virus and bacteria
- Low level of fat and lactose
- Easy to digest
- Establishes *Lactobacillus bifidus*

Transitional milk

- Secreted in the next 3-10 days
- Lower in protein
- Higher fat and lactose than colostrum
- Stimulated by Prolactin and Oxytocin, suckling should be in the first 3 days to stimulate production.

Mature milk

- Secreted from 10-15 days
- Volume increased from 50-1100g/day
- Water constitutes 87%
- Contains Ig
- Higher in lactose and fat
- Contains Lactoferrin and NACL

Hotspot: By altering diet, mother can manipulate the composition of milk



Bioactive components of BM

LO3

Lactoferrin

- iron- binding glycoprotein
- increase iron absorption
- Increase immunity
- Decrease GI infection

Alpha Lactalbumin

- Main whey protein in BM (20-30 of total milk protein)
- Helps in Iron absorption
- Increases immunity (antimicrobial)

Position during BF

Lo4

- Sitting position
- Comfort and relaxed
- Minimize interruption
- Drops arms, supported by a pillow
- Skin to skin contact
- The nipple and most of the areola should be deep in the baby's mouth
- Baby's nose should be clear for easy breathing
- 10-15 minutes from each breast
- At the end of feeding, express few drops on the nipple and areola and allow to dry



BREASTFEEDING POSITIONS



CRADLE
POSITION



CROSS-CRADLE
POSITION



FOOTBALL
HOLD



LAI
D BACK
POSITION



SIDE
LYING

common infant feeding cues

- Waking and tossing
- Sucking fists or fingers
- Crying
- Fussing

Signs of adequacy of milk intake

- Content and satisfied
- Well hydrated
- Healthy
- 6 -8 wet nappies and 2-4 yellow stool per day
- Increase weight





Hotspot: don't give water even in hot weather. BM contains > 80% water

Breast feeding support

LO5

BF support often starts at hospital in baby-friendly hospital

- help mothers initiate first feeding within half hour after delivery
- Show mothers how to initiate BF
- Inform mothers about benefits of BF
- Encourage BF on demand
- No food or drink to the baby below 6 months unless indicated
- No teat or pacifiers

Complications of BF

LO6

Maternal complications

- * Inverted nipple, retract not protrude
 - * Cracked or fissured nipple
 - * Blocked duct results in painful lump, wedge-shaped area
predisposing factors: infrequent BF, poor attachment, tight clothes, trauma.
treatment: frequent feeding, gentle massage, warm compress
 - * Mastitis: symptoms are similar to blocked duct plus fever, malaise
mostly in the first few weeks
treatment: as in blocked duct plus anti-inflammatory
- If severe, give antibiotics

Complication of BF in infant

Ankyloglossia = tongue-tie

Found in 3.2- 4.8% of infants

May not affect lactation

If sucking and rooting reflex not sufficient do frenotomy



Cleft lip and palate

Interfere with compression of nipple

If sucking is not possible use pump



Contraindications of breast feeding

L07

Maternal

- absolute: no
- Relative: HIV, HSV, T.B, Hepatitis C
- Possible: substance abuse, malnutrition.

Infant

- Absolute: Galactosemia, cong. Lactase deficiency
- Relative: PKU, MSU, B oxidation disorder

Breast milk substituents

LO 8

Formula feeding

Cow's Milk-Based Formulas

alternative to human milk

are iron-fortified formula, which permits adequate growth of most infants and is formulated to mimic human milk.

The carbohydrate is generally lactose, although lactose-free cow's milk-based formulas are available.

The caloric density of formulas is 20 kcal/oz (0.67 kcal/mL), similar to that of human milk.



Hotspot: Unmodified cow's milk is unsuitable for feeding in infancy as it contains too much proteins & electrolytes & inadequate iron & vitamins.



Hotspots: Formula-fed infants often gain weight more rapidly than breastfed infants, especially after the first 3 to 4 months of life. Formula-fed infants are at higher risk for obesity later in childhood

Soy Formulas

- Soy protein-based formulas provide an alternative to cow's milk-based formula when intolerance occurs from immune reactions to cow's milk proteins.
- The soy protein is supplemented with methionine to improve its nutritional qualities.
- The carbohydrates in soy formulas are glucose oligomers (smaller molecular weight corn starches) and sometimes sucrose.
- The fat mixture is similar to that used in cow's milk formulas.
- Caloric density is the same as for cow's milk formulas.

Therapeutic Formulas: designed to treat digestive and absorptive insufficiency or protein hypersensitivity.

- Some formulas contain protein hydrolysate. The major nitrogen source of each of these products is a casein or whey hydrolysate, supplemented with selected amino acids. These formulas contain an abundance of essential fatty acids from vegetable oil
- certain formulas provide substantial amounts of medium chain triglycerides, which are water soluble and are more easily absorbed than long chain fatty acids; this is a useful feature for patients with malabsorption.
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- Elemental formulas also are available that contain synthetic free amino acids and varying quantities and types of fat components, especially designed for patients with protein allergy or sensitivity.
- Premature or LBW formula used for LBW babies & premature babies
- Phenylalanine free formula used in Phenylketonuria



Hotspot: CHO content of these specialized formulas varies, but all are lactose free.

Complementary feeding

LO 9

Definition: solid and semi-solid foods in addition to breast milk

Introduction at 6 months is critical to ensure that infants receive sufficient energy and nutrients for growth and development.

successful introduction needs:

- Oral- motor development
- Sufficient renal function
- Sufficient digestion and absorption
- Neurodevelopmental skills



Hotspot: delayed introduction after 9-10 months causes feeding difficulties.



Hotspot: early introduction of CF does not improve G&D and may lead to early weaning

Behavior signs that an infant is ready for CF

- Can remain in sitting position, hold head steady.
- Can swallow food, if pushes food, he is not ready
- Independently pickup food and put in mouth by coordinating eye-hand-mouth movement
- Shows interest in food when others are eating

Type of infant feeding

From 0-6 liquid (breast milk)

6-8 pureed food. 2-3 meal/day + frequent BF, 2-3 table-spoon or half cup

9-11 mashed food, should be able to bite and chew
3-4 meal + BF, additional 1-2 snack can be given

12- 23 progression to family food+ BF

Hotspot: from 6 months, micronutrients in BM are not sufficient particularly Iron, zinc & vit. D, should be provided in complementary food by 9 months

Methods of feeding

Spoon feeding (traditional)

- Start with blended food, then mashed, semi-solid, progress to family food

Risk of obesity

Reduced choking

Baby-led weaning

- Baby offered hand-hold food, escaping the puree stage
- Encourage to feed himself
- Risk of choking
- Lower risk of obesity





Nutritional requirements:

LO 10

1 – **Water:** is essential for life .it functions as solvent for cellular changes, medium for ions, transport of nutrients & waste products & regulation of body temperature

Water accounts for approximately 75-80% of body weight at birth & reaching the adult conc. (50-60%) at age of 8 years, preterm infants have higher TBW than term infants.

Term neonates usually lose 5-10% of their body weight in the first week of life almost all of which is water loss.

The daily requirements of water can be estimated depending on:

a- Age of the infant

Age	fluid req. ml/kg/day
• at birth	75ml (preterm) 60ml(term)
• 5-7 days	150
• 1week -6months	150
• 6m-3yrs	120
• 3 – 6yrs	100
• 6 – 18yrs	70-80
• >18yrs	55-60

b- Body weight & caloric expenditure

- 100 ml of fluid should be provided for every 100 Kcal expended
- So, for the first 10 kg of body weight the caloric expenditure is 100 K cal /kg/day
- The second 10 kg of body weight expend 50 Kcal/kg/day so need 50 ml/kg/day
- Above 20 kg each kg expend 20 Kcal/kg/day so need 20ml/kg/day
- A child with weight of 25kg needs:
 - The first 10 kg (100ml/kg).....1000ml
 - The second 10 kg(50ml/kg).....500ml
 - The remaining 5 kg (20ml/kg).....100
- Total =1600ml/day

Hotspot: The daily requirements of calories is 80-120 Kcal/kg/day for the first yr of life & decreases by 10Kcal/kg for each succeeding 3 yr period

2- Proteins:-

- The amino acids (AA) are essential for the formation of cell protoplasm
- 24 AA have been identified, 9 of them are essential for infants (phenylalanine, isoleucine, leucine, lysine, tryptophane, valine, threonine, methionine) = PHILL TV TM
- 3 AA are essential for LBW infants (arginine, taurine, and cystine)
- 12 AA are non-essential & can be synthesized & not need to be present in the diet

3- CHO

- Is the main source of energy in the diet, in its absence the body uses proteins & fat for energy, stored as glycogen in the liver
- The brain utilizes 80% of glucose intake

4- Fat

- Form the cellular membrane
- Are efficient store for energy
- Act as a vehicle for fat soluble vitamins
- Essential F.A. linoleic & linolenic acids must be supplied in the diet
- Linoleic acid is the precursor for Arachidonic acid, PG,& Leukotrienes
- Linolenic acid is essential for CNS structure

5. Minerals:

Na⁺, Ph⁻ , k⁺, Ca⁺², mg ⁺², Cl⁻etc.
Iron, iodine, copper, zinc, selenium, fluorine

6. Vitamins

The daily requirement of vitamins & trace elements for infants & young children;

- A2000 – 3000 IU\day
- D.....400 IU \day
- K.....5-10 μ g\day
- C.....30 -40 mg\day
- B1, B2, B6.....0.3 – 1mg\day
- B12.....0.3 – 2μ g\day
- B3.....5 - 9 mg \day
- Ca400 -800 mg\day
- Iron.....6 – 10 mg \day
- Zinc.....5 – 10 mg
- Folate25 – 50 mg\day



Thank you

