DIET AND NUTRITION

NUTRITIONAL QUALITY OF BREASTMILK

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Breast milk is the primary source of nutrition before the baby is able to eat and digest other foods (WHO, 2013). It is now an incontrovertible fact that breast milk is a complete food for infants up to six months of age (WABA, n.d). Human milk is uniquely superior to Infant Formula for feeding infants, and is also species-specific (AAP, 1997). All breast milk substitutes differ markedly from it (AAP, 1997). ñHuman milk is the preferred feed for all infants, including premature and sick new-bornsò (AAP, 1997).

Human milk is a complex living biological fluid (Fernández *et* al., 2012). It contains just the right amounts of nutrients in the right proportions for the baby (Fernández *et* al., 2012). The composition of human milk changes during a single feeding and as lactation progresses, while that of infant formulas remains uniform (WABA, n.d). Breast milk is like a living lunch, a menu that changes from feed to feed to meet the childôs needs (WHO, 2013). For example, pre-term milk is specially suited to meet the needs of preterm infants and changes in composition as infants grow (WHO, 2013). Breast milk will also provide antibodies to challenge and protect the baby in case of an infectious agent in the babyôs surroundings (Newburg, 2005). It is processed gently through the babyôs digestive system so that these important nutrients are easily absorbed (Newburg, 2005). Breast milkôs features include special factors and hormones that contribute to the optimal health, growth and development of infants (AAP, 1997). Current research indicates that human milkôs protective qualities last well into adulthood (Newburg, 2005; Cafe-Costanilla, 2012).

There are more than 200 constituents of Breast milk known to science (Dewar, 2008). Human milk contains at least one hundred ingredients not found in any artificial infant milk (Dewar, 2008). As laboratory methods become more refined, new constituents are discovered.

Composition of Breast Milk and Functions of its Constituents

- Basic nutritional information:

  According to a British report (Department of Health and Social Security, 1988), each 100ml of mature Breast milk (i.e. Breast milk produced after 21 days of lactation) yields approximately:

  - 70 Calories
  - 89.97g Water
  - 7.4g Carbohydrates (primarily lactose)
  - 4.2g Fat
  - 1.3g Protein

  Some of the main constituents of breast milk are described below:

- **Colostrum**

  - Colostrum contains over sixty components, thirty of which are exclusive to human milk

  - Colostrum is high in the immunoglobulin A (IgA), which coats the gastrointestinal tract. This helps to protect the new born until its own immune system is functioning properly, and creates a mild laxative effect, expelling meconium and helping to prevent the build up of bilirubin, a contributory factor to jaundice.

  - It is high in protein, as well as fat-soluble vitamins and minerals

  - Colostrum contains high amounts of sodium, potassium, chloride and cholesterol believed to enhance optimal development of the babyôs heart, brain and central nervous system.

  - The yellow colour of colostrum is due to high levels Beta-carotene (pro-vitamin A, 10 times more than is found in mature milk), one of the many anti-oxidants present.

  - Colostrum contains elevated levels of vitamin E and Zinc. Vitamin E is an anti-oxidant and Zinc is necessary, among other things, for the control of diarrhoea and its frequency in children.

- **Carbohydrates**

  Lactose accounts for the majority of carbohydrates in human milk. It enhances calcium absorption and metabolizes into galactose and glucose, which supplies energy to the infantôs rapidly growing brain (APP, 1997).

- **Fat**

  Human breast milk contains between 30 and 50 gm per litre of fat (Auestad et al., 2003). This provides about half of the calories in breast milk (Auestad et al, 2003). When an infant is born premature, motherôs breast milk contains a higher amount of calorie-dense fats (Hadders-Algra et al, 2007). Breast milk contains all the necessary types of fats, including the essential fatty acids (Dewar, 2008). The amount of fat in the motherôs diet does not affect the amount of fat in the breast milk; however, the composition of fats may be different (Dewar, 2008).

  The fat content of breast milk is important for babyôs health. As the principal source of calories in breast milk, fat determines how much milk the baby needs to consume to meet his needs. Fat content is an important determinant of growth rates (Hadders-Algra et al, 2007). It is needed to metabolize many vitamins, so too little fat is associated with vitamin deficiencies (Hadders-Algra et al, 2007).

  In addition, some types of fatty acids found in the breast milk- the long-chain poly-unsaturated fatty acids, or LCPs, are believed to play important roles in brain development (Auestad et al, 2003). The most well-known is docosahexanoic acid (DHA). This fatty acid helps the brain manufacture myelin, a sheath that insulates nerve fibres (Auestad et al, 2003). The brains of breastfed babies have higher concentration of DHA than do the brains of formula fed babies (Makrides *et* al.,

1994). It is believed that this is responsible for the IQ gap between breastfed and formula-fed (lower) babies.

Cholesterol is another fatty component of breast milk important for brain development. Like DHA, cholesterol is crucial to the production of myelin (Pond, 2003). Infant formula does not contain cholesterol.

- **Protein**

  There are two classes of protein in milk- the caseins and the whey. Caseins turn into clots or curds in the stomach. The whey remains liquid and are easier to digest.

  About 60% of the proteins in mature breast milk are whey (Jenness, 1971). That is a lot compared with other mammals. In the cow, for instance, whey represents only 18% of milk proteins (Jenness, 1971). Most baby formulas are high in Casein (Dewar, 2008). This makes them harder to digest than breast milk. Whey and casein vary in proportion as the infant ages (e.g. about 90% whey in the first breast feedings and about 60% in mature breast milk).

  Proteins, apart from being the building blocks of muscle and bones, also serve a wide range of other functions, including defense against pathogens (Dewar, 2008). For instance, immunoglobulin A (IgA) is a protein that attacks respiratory viruses, bacteria and intestinal parasites (Dewar, 2008). Like other antimicrobial factors in human breast milk, it protects the respiratory and intestinal tracts of breastfeeding infants (Institute of Medicine, National Academy of Sciences, 1991).

- **Dynamic nature of breast milk constituents**

  Breast milk changes during the course of a feeding and throughout the day, it is secreted first as **Foremilk,** which satisfies the babyôs initial thirst. Foremilk is watery, low in fat and high in carbohydrates relative to the creamier **Hind milk,** which is

released as the feeding progresses. Hind milk is high in fat and calories, satisfies the babyôs hunger and promotes its growth and development. This is why it is important for the infant to spend more time at each breast during a feeding. Some breastfed babies are known to cry a lot, but the un-informed mothers are not aware that the babiesô discomfort can be trace to hunger cause by break in breastfeeding after the being allowed to take the foremilk only, and being deprived of the hind milk which is more filling.

Pre-term milk differs markedly from full-term milk by offering pre-mature babies longer access to colostrum, higher levels of Immunoglobulin A (IgA) and other anti-infective properties. Pre-term milk also contains greater concentrations of triglycerides and long-chain fatty acids. These qualities offer the pre-mature infant optimal nutrition for its short-term energy needs as well as for its long-term neurological and visual development. Pre-term milk also offers the best protection from necrotizing enterocolitis (NEC), an often fatal condition in premature babies.

Summary of the Differences between Human Breast Milk and other Milk Sources

S/No	Component	Human Milk	Animal Milk	Formula
1	Bacterial Contaminants	None	Likely	Likely during reconstitution. May be intrinsically contaminated with Enterobacter sakazaki
2	Anti-infective factors	Present	Not present	Not present
3	Growth factors	Present	Not present	Not present
4	Protein	Correct amount, easy to digest	Too much, difficult to digest	Partly digested
5	Fat	Enough essential fatty acids; contains lipase	Lacks essential fatty acids, no lipase	Lacks essential fatty acids, no lipase
6	Iron	Small amount, well	Small amount,	Extra added, not well

		absorbed	not well absorbed	absorbed
7	Vitamins	Enough		Vitamins added
8	Water	Enough	Extra needed	May need extra

Storage Ability of 'Expressed'' Breast milk (Academy of Breastfeeding Medicine Protocol)

Expressed breast milk can be stored for later use. It is recommended that the milk is stored in hard-sided containers (e.g. stainless steel) with air-tight seals.

S/No	Place of Storage	Temperature ^{o}C	Max Duration of Storage
1	In a room	25	6-8 hours
2	Insulated thermal bag with ice packs	-	Up to 24 hours
3	In a refrigerator	4	Up to 5 days
4	Freezer compartment inside a refrigerator	-15	2 weeks
5	A combined refrigerator and freezer with separate doors	-18	3-6 months
6	Chest or upright manual defrost deep freezer	-20	6-12 months

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