CALORIC REQUIREMENTS

1. Energy expenditures of physical activity and work.

It is the largest caloric expenditure, it is about 1/4th of the total energy expenditure of a moderately active person.

Depends on the specific physical activity, the energy cost of the activity, the time spent on the activity and the body size of the individual.

2. Work efficiency

Defined as the ratio of the work done to the energy required to accomplish it, calculated by dividing the amount of work done by the amount of extra heat produced in doing the work.

3. Energy requirement

The total energy of an individual represents the sum of the energy expenditures for the basal metabolism, for physical activities or work and for the specific dynamic effect of food. One can use accepted standards or tables of recommended energy allowances.

4. Calorie undernutrition and over nutrition

Western countries: food plentiful have problem of overweight but developing countries undernutrition.

NUTRITION IN CHILDHOOLD

At birth a baby has sufficient store of brown fat and glycogen which can be metabolized to produce heat for the maintenance of body temperature. The food given within the first few hours of life is to maintain a safe blood glucose level and to initiate milk flow. By the end of the 1st week, the rate of growth and weight gain of the infant is

faster than at any other postnatal time when the baby gains between 180 and 210 g/wk. To achieve this, 1.5g per kg/day of proteins are required with sufficient calories from carbohydrates in the milk. At this time 1/3 of the total caloric uptake is expended for growth.

Human milk contains appropriate amount of all necessary nutrient, including the essential fatty acids, arachidonic and linoleic acids needed for optimal brain development. The amount of food required by each baby depends on the rate of metabolism, how active the baby is and on the need to keep him warm.

Gastric motility is poorly coordinated in the fruit few weeks of life, leading to poor natural mixing and therefore less digestion of solid foods. By the 12^{th} weeks of age, intestinal peristalsis of a type seen in older children and adults develops but it is slower.

Intestinal mucosa permeability is greatest during the neonatal period and many large molecules including protein tend to be absorbed intact. The intestinal mucosa α-glucosidases (sucrase, maltase, isomaltase) are well developed by 32 weeks of gestation and are present at near adult level at term. For premature infants (27-32 weeks gestation) formulas with less than 60% of total carbohydrate calories as lactose are best tolerated.

See table in textbook on RDA for normal infants and Yg children for selected nutrients.

FEEDING THE PRE-TERM (LOW BIRTH WEIGHT) BABY

The most generally accepted goal for nutritional management of the pre-term (LBW) infant is to provide sufficient amounts of all nutrients to support continuation of the intrauterine growth rates. The initial practice of feeding pre-term infants with milk

was abandoned fifty years ago following the demonstration that protein intakes higher than those provided by human milk resulted in a greater rate of weight gain.

Also breast milk cannot supply the infant with as much calcium and phosphorus and sodium, iron, copper as it would have obtained from its mother circulation. The smaller the infant (pre-term) the more marked is its inability to withstand starvation while the term baby has sufficient resume to survive a total starvation condition for a month. Once feeding has become established in a baby weighing 1kg or less it should be given sufficient food to enable it to grow at the same rate as it would have done had it not been born.

INFANT FEEDING

Breast feeding is universal in the rural areas of Africa but its importance is diminished in the cities. It is the best means of delivering nutrients to the new born. A mother must be encouraged to feed adequately, exercise, rest and have freedom from anxiety in order to fulfill this function. Because of its ready availability, its safety and the promotion of enhanced resistance to infection and bonding between the mother and infant, human milk is the perfect food. But in cases where the mother dies after child birth or she has to return to work immediately artificial feeding is used.

The period of neonatal life and early infancy is characterized by rapid growth but the human infant grows less rapidly than the young of other mammals e.g. calf doubles its weight tin 1month but in man, 4-5 months.

COMPOSITION OF COLOSTRUM, HUMAN MILK AND COW'S MILK

See table in texbook.

The belief that human milk has a constant composition is false. The effect of very poor nutrition on a lactating mother is to reduce the quantity, and the quality of the breast milk e.g. if a mother's diet is deficient in thiamine, it produces less of it in her milk. Infant can also grow well on cow's milk or formular but breast milk is cheaper and safe microbiologically.

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BREAST FEEDING VS BOTTLE FEEDING

Breast milk remains the preferred food for human infants. Although science and industry have combined their skills to produce cow milk products which contain nutrients in qualities that are similar to those in breast milk statistical advantages of breast feeding persists. Mother who choose to feed their infants with formula should not be made to feel guilty if they can afford to do it properly.

Advantages

1. Breastfeeding gives a safe and protected feeding to the infant and a sense of satisfaction to the mother. It fosters good mother child relationship. Prolongation of breast feeding may cheat the infant of needed nutrition.
2. There is a reduced likelihood of diarrhea. Stools of infants fed breast milk has lower pH (5.4) than those fed cow milk (6.9) which promotes greater growth of pathogenic bacteria in the GlT of those fed cow milk.
3. It confers immunity on the child because of the presence of immunoglobulins and other constituents of breast milk. Also the reduced IgA in the breast milk promotes microorganisms in the infants intestine that is antagonistic to certain pathogen.

4. Human colostrums contain lactoferrin, which by building iron makes it unavailable to *E. coli* in the intestine, thus inhibiting their growth. Other binder protein which bind zinc, vitamin B12 and folate are also present.
5. It is available and convenient, and at right temperature no preparation is necessary.
6. It confers an economic benefit on the family
7. It has contraceptive effect and can delay the return of ovulation by 5-8 months.
8. The human milk contains an enzyme which aids protein digestions. Taurine an amino acid is present only in human not cow's milk. Lactose also aids the absorption of Ca, Mg and amino acids whereas some commercial formulas substitute syrup or sucrose for lactose since neither of these yield galactose on hydrolysis a deficiency of galactose may affect the development of the neonate.

These facts show that no other food is equal to that of the human milk for child nutrition provided that the mother has maintained adequate nutrition herself. Epidemiological observations show that following the feeding of such artificial milk products:

1. There were widespread outbreaks of rickets in the early part of the century.
2. There were cases of neonatal tetany in the early 50's
3. There were reported cases of pyridoxine deficiency also in the late 50s

Epidemiological observations show that following the feeding of such artificial milk products:

1. There were widespread outbreaks of rickets in the early part of the century.
2. There were cases of neonatal tetany in the early 50's

and 60s.

4. Hemolysis due to vitamin E deficiency were also recorded Epidemiological observations show that following the feeding of such artificial milk products:

1. There were widespread outbreaks of rickets in the early part of the century.
2. There were cases of neonatal tetany in the early 50's
5. Risks of high plasma sodium (hypernatremia) have also been noted in recent years.
6. Variation or the quality of constituted milk in affluent homes over concentration can lead to infant obesity or other dilution may lead to marasmus.
7. It is costly, the mother may not be able to sustain it.
8. The gut flora of the artificially fed infant is made up largely of *E. coli*, and *Streptococcus fecalis* in contrast to the breast fed infant in whom the lactobacillus predominates but the breast milk protects against this.
9. The poor environmental sanitation in such places

FACTORS MILITATING AGAINST BREAST FEEDING

1. The mother's milk production may be less than half of the infant needs.
2. The mother may suffer from some chronic illnesses such as cardial diseases, tuberculosis, severe anemia, nephritis epilepsy, insanity, chronic fever and AIDS.
3. Another pregnancy occurs, although this may not stop breast milk flow.
4. The mother has to return to work outside the home

5. The infant is weak or unable to nurse because of cleft palate or half-lip or the mother has acute infection.

NUTRITIONAL ASPECTS OF GROWTH AND DEVELOPMENT

Growth is the increase in size from embryo to adulthood. The metabolic rates of infants and children are greater and the turnover of nutrients are more rapid than in the adult. Therefore, the nutritional needs for growth and development are superimposed upon maintenance requirements that are higher than in adults.

Each infants growth and development are determined by (a) the characteristics acquired from parents (b) the quality of nutrition of the mother during pregnancy (c) the adequacy of breastfeeding or formula feeding and the supplements offered throughout infancy.

Height and weight are compared to charts that depict a normal population. The best assessment of normal growth should be – measurement of body size (anthropometric) body composition and body cells.

It is the physiological age of a child that determines its nutrient needs. Physiological age is matched by the chemical index of growth, marked by urinary excretion of hydroxyproline (component of skin, tendons etc). Its rapid synthesis takes place during growth and reflected in an increased rate of its excretion.

Several criteria are used to determine whether an infant is well nourished or not

- a steady gain in height and weight
- sleeps well, is happy, is vigorous.

- has firm muscles and a moderate amount of subcutaneous fat, teeth begin to appear 5-6months, normally eliminates fecal waste after feeding.

Infants grow and develop more rapidly during the 1st year than at any other time. Birth weight is doubled in about 5 months, tripled by one year and quadrupled by 2 to 3 yrs. This growth is reflected in the Ponderal Index (P.I.) = weight / Height^3 x 100. The relation of bone weight to body weight is constant during life. The growth of a child tapers off after the 1st year. An infant's body contains a much higher percentage of water than that of older children and adults. Their muscles are poorly developed and the amount of subcutaneous fat is limited.

The 1st request of a new born is O_2 for its lungs to expand and circulation to be re-routed next is warmth, followed by feed and water and the digestive organs have to come into operation. It is able to digest proteins, emulsified fats and single sugars. Starches and most fats are poorly digested because of pancrease . The kidneys reach their full functional capacity by the end of the first year.

The Hb level at birth is about 17-20 g/100ml the level becomes lower as the infant grows and the body circulation expands. The level remains satisfactory until the 3rd month when iron rich foods are introduced.

The brain develops rapidly such that it completes its growth earlier than the rest of the body. 60% at birth, 4years 80%, complete 10 years. Severe malnutrition at any of these times leads to a reduction in the number of brain cells.

Growth processes are controlled by factors such as genetic and environmental factors amongst which is nutrition.

NUTRITIONAL REQUIREMENTS DURING INFANCY

After birth, a normal full term healthy baby should be put to the breast, (not later than 4 hours). If no breast milk is forthcoming the baby may be put to 10% dextrose or 5% sucrose or plain water. Eating at the time involves 3 mechanisms (1) rooting (searching for the nipple), sucking (continuously or intermittently) and swallowing well coordinated with breathing allowing milk to go to the eosophagus instead of the lungs.

During the early period the infant needs between 6-8 feedings/day, as the stomach capacity increases 4-6 times at 5 months. After first week supplement of vitamin A, C and D should be offered. Some breast fed infants develop physiologic jaundice possibly due to functional immaturity of the liver, this will clean off within a few days with normal breast milk.

ENERGY NEEDS

The energy allowance recommended for infants is based on energy consumption of normal children. A new born full term baby increases his daily energy intake per unit of body weight until he is about 6 months when he is causing about 117 to 120KCal/kg, this drops to about 108KCal/kg between 6-12 months. These allowances cover the estimated energy needs.

Activity	0-6 months (KCal/kg)	6-12 months (KCal/kg)
Basal metals	60	55
Growth	15	35
Normal activity	35	10-25

Specific dynamic action	5	5
Fecal losses	5	5

The energy consumption of formula fed infants depends on the concentration of the formula needs but that of mammalians milk is constant at about 75 KCal/100ml.

CARBOHYDRATE REQUIREMENTS

As a rule roughly half of an infant's caloric requirement should be supplied as carbohydrate since infants consuming carbohydrate free diets develop ketosis. Lactose is the carbohydrate and its quality in cow's milk is 70% of that in man providing 29% and 38% of the milk energy. Most milk formula provides 40-50% of the energy as carbohydrate. Whenever it is greater the 50%, some of it is not hydrolyzed and absorbed, it exert an osmotic effect causing water to enter the intestine resulting in diarrhea or may be insufficient lactase leading to accumulation of lactose which when acted upon by bacteria causes diarrhea.