**III B.Sc Nutrition, FSM & Dietetics**

# NUTRITION THROUGH LIFE CYCLE

**CNU52**

## UNIT-I

Basic concept of RDA for Indians- Purpose of requirement. General Concept about growth and development through different stages of life. Energy and other nutrient for their growth and development

## RECOMMENDED DIETARY ALLOWANCES

***Definition***

RDA is defined as the nutrient present in the diet, which satisfies the daily requirements ofnearly all individual in a population

These many addition of safety factor amount to the estimated requirements to cover the variation among individuals losses during cooking and the lack of precision inherent in the estimated requirement

**Recommend Dietary Allowances = Requirements + safety facts**

Humans need a wide range of nutrients to lead a healthy and active life. The amount of each nutrient needed for an individual depends on age, body weight, physical activity, physiological state (pregnancy, lactation) etc. So basically the requirement for nutrients varies from individual to individual. So, what do we mean by the term "Nutrient Requirement" here? The requirement for a particular nutrient is the minimum amount that needs to be consumed to prevent symptoms of deficiency and to maintain satisfactory level of the nutrient in the body.

For example in case of infants and children, the requirement may be equated with the amount that will maintain a satisfactory rate of growth and development. Similarly for an adult the nutrient requirement is the amount that will maintain body weight and prevent the depletion of the nutrient from the body which otherwise may lead to deficiency. In physiological condition like pregnancy and lactation, adult women may need additional nutrients to meet the demand of fetal growth along with their own nutrient needs. Now within each group (say infants or an adults etc) there may be individual variations in the nutrient requirements. For instance, there may be a period of low intake or the quality of the diet may vary, similarly the effect of cooking and processing may be different and bioavailability of the nutrient from the diet may also vary.

### SIGNIFICANCE/USES OF RDA

RDA, we know, represents the level of the nutrient to be consumed daily to meet all the requirements of most of the individuals in a given population. So RDA's help us plan balanced

diets which include a variety of foods derived from diverse food groups which help meet the nutrient requirements. Other than this basic use, RDA's have come to serve many important purposes. The various applications of RDA include:

- Comparison of individual intakes to the RDA allows an estimate to be made about the probablerisk of deficiency among individuals,

- Modifying nutrient requirements in clinical management of diseases,

  To help public health nutritionists to compose diets for schools, hospitals, prisons etc.

- For health care policy makers and public health nutritionists to design, develop nutritionintervention programmes and policies,

- For planning and procuring food supplies for population groups,

- For evaluating the adequacy of food supplies in meeting national nutritional needs, Forinterpreting food consumption records of individuals and populations,

- For establishing Standards for the national feeding programmes implemented by the Governments for its vulnerable population,

- For designing nutrition education programmers for the masses,

- For developing new food products and dietary supplements by the industry,

  Establishing guidelines for the national labeling of packaged foods (by Food Standards SafetyAuthority of India (FSSAI)).

**FACTORS TO BE CONSIDERED**

RDA of an individual depends upon many factors like age, sex, physical week, and physiologicalstress

1. Age – An adult requires more total calories than a child, due to larger size of the body and increase in activity. A growing chid requires more calories and protein /kg of body weight thanan adult
2. Sex – females requires less calories than male as BMR is lower & size of the body is smaller
3. Physical work – sedentary worker require less calories and B- vitamin than hard working persons
4. Physiological stress – during pregnancy and lactation period requirement of nutrient asincreased

***REQUIREMENTS AND RDA***

To translate the nutrient requirements into RDA or RDI ( Recommended dietary intake), allowances forbio availability and inter individual variation must be made

***RDA includes:***

1. A margin of safety to take into account Possible losses of nutrients during cooking and storage to provide a buffer against increased requirement during illness is other stages ofnutritional stress
2. While prescribing the RDA for a given nutrient the intakes of all other nutrients areconsidered to be at a safe level
3. RDA is therefore not applicable to undernourished or malnourished individual or thosesuffering from disease or infective morbidity

## RECOMMENDED DIETARY ALLOWANCES FOR INDIANS

Recommended Dietary Allowances (RDA) for Indian Population for the Indian population, the dietary standards have been computed by the Indian Council of Medical Research (ICMR). Theserecommendations have been published as "Nutrient Requirements and Recommended Dietary Allowances for Indians" (ICMR 2010)

The recommendations are constantly revised whenever new data is available. The last recommendations were revised in 2010, based on the new guidelines of the International Joint FAO/WHO/UNU Consultative Group and based on the data on Indians that had accumulated after 1989 recommendations. Table 1(a) and Table 1(b) present these recommendations. Study them carefully. To help you understand these recommendation here are a few highlights:

1. Note, the RDA for Indians are presented for the different age categories: 0-6 months, 7 to 12 months, 1

– 3 years, 4 – 6 years, 7 – 9 years, 10 – 12 years, 13 – 15 years,16 – 18 years, adult man and women..

2. Recommendations are given for energy and all other nutrients including proteins, visible fat, calcium, iron, retinol, Beta Carotene, thiamine, riboflavin etc.

3. Recommended dietary allowances for adults are based on sex (male, female), body weight and physicalactivity level (i.e. Sedentary, Moderate and Heavy work).

4. RDA for energy is expressed in kilocalories (Kcal), for proteins, fats in grams (g), and for calcium, iron,vitamins and minerals in milligram (mg) or microgram.

5. RDA for protein is based on body weight. The relationship can be expressed as 1g protein per kg body weight in the case of adults. It varies for other age categories.

6. RDA for energy and protein are given as additional intakes in pregnancy and lactation, indicated by a (“+ "sign). This requirement is over and above the normal requirement of adult women. RDA for other nutrients is given as total intake figures.

7. In infancy RDA's for energy, protein, iron, thiamin, riboflavin and niacin are expressed as per kg body weight (expected for a healthy, normal growing infant of a particular age)

8. RDA for Vitamin A have been given in terms of retinol or alternatively in terms of Beta Carotene.

## GROWTH AND DEVELOPMENT THROUGH DIFFERENT STAGES OF LIFE CYCLE

### MEANING AND IMPORTANCE OF THE DIFFERENT SATGE IN LIFE.

Each child's growth pattern is unique and special: no two children

Ever develop at the same rate. Nevertheless, there is an orderly sequence. In the course of human

life. A stage is. A period during which certain change occur (smart and smart ,1971). Every stage is built upon the

Foundation of the development of the previous stages. Each stage is designated. According to the child's activities during that period.

Irrespective of racial or cultural differences of the human growth process follows a general development pattern of different stages in which certain distinct period can be make off.

**Periods of Development**

Development of the human body is the process of growth to maturity. The process begins with fertilization, where an egg released from the ovary of a female is penetrated by a sperm cell from a male. The resulting zygote develops through mitosis and cell differentiation, and the resulting embryo then implants in the uterus, where the embryo continues development through a fetal stage until birth. Further growth and development continues after birth, and includes both physical and psychological development, influenced by genetic, hormonal, environmental and other factors. This continues throughout life: through childhood and adolescence into adulthood. There are three broad stages of life cycle.

- Prenatal Development
- Infancy and Toddlerhood
- Early Childhood
- Middle Childhood
- Adolescence
- Early Adulthood
- Middle Adulthood
- Late Adulthood

**Prenatal Development**

Conception occurs and development begins. All of the major structures of the body are forming and the health of the mother is of primary concern. Understanding nutrition, (or environmental factors that can lead to birth defects), and labor and delivery are primary concerns.

**Infancy and Toddlerhood**

The first year and a half to two years of life are ones of dramatic growth and change. A newborn, with a keen sense of hearing but very poor vision is transformed into a walking, talking toddler within a relatively short period of time. Caregivers are also transformed from someone who manages feeding and sleep schedules to a constantly moving guide and safety inspector for a mobile, energetic child.

**Early Childhood**

Early childhood is also referred to as the preschool years consisting of the years which follow toddlerhood and precede formal schooling. As a three to five-year-old, the child is busy learning language, is gaining a sense of self and greater independence, and is beginning to learn the workings of the physical world. This knowledge does not come quickly, however, and preschoolers may have initially have interesting conceptions of size, time, space and distance such as fearing that they may go down the drain if they sit at the front of the bathtub or by demonstrating how long something will take by holding out their two index fingers several inches apart. A toddler' s fierce determination to do something may give way to a four-year-olds sense of guilt for doing something that brings the disapproval of others.

**Middle Childhood**

The ages of six through eleven comprise middle childhood and much of what children experience at this age is connected to their involvement in the early grades of school. Now the world becomes one of learning and testing new academic skills and by assessing one' s abilities and accomplishments by making comparisons between self and others. Schools compare students and make these comparisons public through team sports, test scores, and other forms of recognition. Growth rates slow down and children are able to refine their motor skills at

this point in life. And children begin to learn about social relationships beyond the family through interaction with friends and fellow students.

**Adolescence**

Adolescence is a period of dramatic physical change marked by an overall physical growth spurt and sexual maturation, known as puberty. It is also a time of cognitive change as the adolescent begins to think of new possibilities and to consider abstract concepts such as love, fear, and freedom. Ironically, adolescents have a sense of invincibility that puts them at greater risk of dying from accidents or contracting sexually transmitted infections that can have lifelong consequences.

**Early Adulthood**

The twenties and thirties are often thought of as early adulthood. (Students who are in their mid 30s tend to love to hear that they are a young adult!). It is a time when we are at our physiological peak but are most at risk for involvement in violent crimes and substance abuse. It is a time of focusing on the future and putting a lot of energy into making choices that will help one earn the status of a full adult in the eyes of others. Love and work are primary concerns at this stage of life.

**Middle Adulthood**

The late thirties through the mid-sixties is referred to as middle adulthood. This is a period in which aging, that began earlier, becomes more noticeable and a period at which many people are at their peak of productivity in love and work. It may be a period of gaining expertise in certain fields and being able to understand problems and find solutions with greater efficiency than before. It can also be a time ofbecoming more realistic about possibilities in life previously considered; of recognizing the difference between what is possible and what is likely. This is also the age group hardest hit by the AIDS epidemicin Africa resulting in a substantial decrease in the number of workers in those economies.

**Late Adulthood**

This period of the life span has increased in the last 100 years, particularly in industrialized countries. Late adulthood is sometimes subdivided into two or three categories

such as the " young old" and " old old" or the " young old" , " old old" , and " oldest old" . We will follow the formercategorization and make the distinction between the " young old" who are people between 65 and 79 and the " old old" or those who are 80 and older. One of the primary differences between these groups is thatthe young old are very similar to midlife adults; still working, still relatively healthy, and still interested inbeing productive and active. The " old old" remain productive and active and the majority continues to live independently, but risks of the diseases of old age such as arteriosclerosis, cancer, and cerebral

vascular disease increases substantially for this age group. Issues of housing, healthcare, and extending active life expectancy are only a few of the topics of concern for this age group. A better way to appreciate the diversity of people in late adulthood is to go beyond chronological age and examine whether a person is experiencing optimal aging (like the gentleman pictured above who is in very good health for his age and continues to have an active, stimulating life), normal aging (in which the changes are similar to most of those of the same age), or impaired aging (referring to someone who has more physical challenge and disease than others of the same age).

## ENERGY AND OHER NUTRIENT FOR THEIR GROWTH AND DEVELOPMENT:

We need essential amino acids, carbohydrates, essential fatty acids, and an array of vitamins and minerals to sustain life and health. However, nutritional needs vary from one life stage to another. During intrauterine development, infancy, and childhood, for example, recommended intakes of macronutrients and most micronutrients are higher relative to body size, compared with those during adulthood. In elderly persons, some nutrient needs (e.g., vitamin D) increase, while others (e.g., energy and iron) are reduced.

Changing Nutrient Needs Through the Life Cycle

| Life Stage | Change in Nutrient Needs |
|---|---|
| Pregnancy* | Increased requirements: energy, protein, essential fatty acids, vitamin A, vitamin C, B-vitamins (B1, B2, B3, B5, B6, B12, folate, choline) & calcium, phosphorus,** magnesium, potassium, iron, zinc, copper, chromium, selenium, iodine, manganese, molybdenum |
| Lactation* | Increased requirements: vitamins A, C, E, all B-vitamins, sodium, magnesium**<br>Decreased requirements: iron |
| Infancy, childhood* | Increased requirements: energy, protein, essential fatty acids |
| Adolescence* | Increased requirements: energy, protein, calcium, phosphorus, magnesium, zinc (females only) |
| Early adulthood (ages 19-50) | Increased requirements for males, compared with females: vitamins C, K; B1, B2, B3, and choline; magnesium, zinc, chromium, manganese<br>Increased requirements for females, compared with males: iron |
| Middle age (ages 51-70)* | Increased requirements: vitamin $B_6$, vitamin D |
| Elderly (age 70+)* | Increased requirements: vitamin D<br>Decreased requirements: energy; iron (females only) |

**Pregnancy and Lactation**

Pregnant and lactating women have increased requirements for both macronutrients and micronutrients. The failure to achieve required intakes may increase risk for certain chronic diseases in their children, sometimes manifesting many years later.For instance, studies of the Dutch famine during World War II (in which rations were progressively cut from 1400 cal/d in August 1944 to 1000 cal/d in December, and ultimately to 500 cal/d) found that undernutrition during mid- to late pregnancy increased the risk for glucose intolerance and resulted in greater progression of age-related hypertension.[39] Malnutrition of women during early pregnancy correlated with higher body weights of their offspring as adults, along with increased risk for coronary heart disease and certain central nervous system anomalies.

Protein requirements in pregnancy rise to 1.1 g/kg/d to allow for fetal growth and milk production. The source of protein may be as important as the quantity, however. Some evidence suggests that protein requirements can be more safely met by vegetable than by animal protein. Meat is a major source of saturated fat and cholesterol; it is also a common source of ingestible pathogens and a rich

source of arachidonic acid, a precursor of the immunosuppressive eicosanoid PGE2.

Pregnant women also should not meet their increased need for protein by the intake of certain types of fish, such as shark, swordfish, mackerel, and tilefish, which often contain high levels of methylmercury, a potent human neurotoxin that readily crosses the placenta.Other mercury-contaminated fish, including tuna and fish taken from polluted waters (pike, walleye, and bass), should be especially avoided.There is no nutritional requirement for fish or fish oils. Vegetable protein sources, aside from meeting protein needs, can help meet the increased needs for folate, potassium, and magnesium and provide fiber, which can help reduce the constipation that is a common complaint during pregnancy.

Pregnant and/or lactating women also require increased amounts of vitamins A, C, E, and certain B vitamins (thiamine, riboflavin, niacin, pyridoxine, choline, cobalamin, and folate). Folate intake is especially important in early pregnancy for the prevention of neural tube defects and should be consumed in adequate amounts prior to conception; evidence shows that average intakes are only~60% of current recommendations.[44] Folate intakes were noted to be poorest in women eating a typical Western diet and highest in women eating vegetarian diets.Regardless of folate consumed from food sources, women capable of becoming pregnant are recommended to take 400 mcg/d of folic acid to reduce the risk of neural tube defects.

Pregnant women also require increased amounts of calcium, phosphorus, magnesium, iron, zinc, potassium, selenium, copper, chromium, manganese, and molybdenum.[1] Prenatal vitamin-mineral formulas are suggested to increase the likelihood that these nutrient needs will be met.

**Infancy and Early Childhood**

Requirements for macronutrients and micronutrients are higher on a per-kilogram basis during infancy and childhood than at any other developmental stage. These needs are influenced by the rapid cell division occurring during growth, which requires protein, energy, and nutrients involved in DNA synthesis and metabolism of protein, calories, and fat. Increased needs for these nutrients are reflected in DRIs for these age groups, some of which are briefly discussed below.

**Energy**. While most adults require 25 to 30 calories per kg, a 4-kg infant requires more than 100 cals/kg (430 calories/day). Infants 4 to 6 months who weigh 6 kg require roughly 82 cals/kg (490 calories/day). Energy needs remain high through the early years. Children 1 to 3 years of age

require approximately 83 cals/kg (990 cals/d). Energy requirements decline thereafter and are based on weight, height, and physical activity.

As an energy source, breast milk offers significant advantages over manufactured formula. Breastfeeding is associated with reduced risk for obesity, allergies, hypertension, and type 1 diabetes; improved cognitive development; and decreased incidence and severity of infections.[46] It is also less costly than formula feeding.

**Protein**. Older infants, aged 7-12 months, have a Recommended Daily Allowance (RDA) for protein of 1.2 g/kg/d, or 11 g/d of protein. Children aged 1–3 years have an RDA of 1.05 g/kg/d or 13 g/d of protein and children aged 4–8 years have an RDA of 0.95 g/kg/d or 19 g/d of protein.

**Water**. Total water requirements (from beverages and foods) are also higher in infants and children than for adults. Children have larger body surface area per unit of body weight and a reduced capacity for sweating when compared with adults, and therefore are at greater risk of morbidity and mortality from dehydration.[52] Parents may underestimate these fluid needs, especially if infants and children are experiencing fever, diarrhea, or exposure to extreme temperatures (e.g., in vehicles during summer).

**Essential fatty acids.** Requirements for fatty acids on a per-kilogram basis are higher in infants than adults (see below). Through desaturation and elongation, linolenic and alpha-linolenic acids are converted to long-chain fatty acids (arachidonic and docosahexanoic acids) that play key roles in the central nervous system. Since both saturated fats and trans fatty acids inhibit these pathways, infants and children should not ingest foods that contain a predominance of these fats.

**Adolescence and Adulthood**

The Institute of Medicine recommends higher intakes of protein and energy in the adolescent population for growth. For most micronutrients, recommendations are the same as for adults. Exceptions are made for certain minerals needed for bone growth (e.g., calcium and phosphorus). However, these recommendations are controversial, given the lack of evidence that higher intakes are an absolute requirement for bone growth. Evidence is clearer that bone calcium accretion increases as a result of exercise rather than from increases in calcium intake.

Micronutrient needs in adults 19 to 50 years of age differ slightly according to gender. Males require more vitamin C, K, B1, B2, and B3; choline; magnesium; zinc; chromium; and manganese.

Menstruating females require more iron, compared with males of similar age.

**Later Years**

Due to reductions in lean body mass, metabolic rate, and physical activity, elderly persons require less energy than younger individuals need. Some DRIs for elderly persons differ from those of younger adults. For example, in order to reduce the risk for age-related bone loss and fracture, the DRI for vitamin D is increased from 600 IU/d in individuals 19-70 years of age to 800 IU/d for those > 70 years of age.Suggested iron intakes drop from 18 mg per day in women ages 19-50 to 8 mg/d after age 50, due to iron conservation and decreased losses in postmenopausal women, compared with younger women.Although diets that are modest in protein have been associated with health benefits, including reductions in diabetes and cancer incidence and overall mortality for people aged 65 and under, for those over aged 65, it remains important to ensure adequate protein intake for older people. Plant sources of protein are preferable.

Alcohol intake can be a serious problem in elderly persons. The hazards of excess alcohol intake include sleep disorders, problematic interactions with medications, loss of nutrients, and a greater risk for dehydration, particularly in those who take diuretics. Roughly one-third of elderly persons who overuse or abuse alcohol first develop drinking problems after the age of 60 years.