

NUTRITION

(LECTURE 1)

OBJECTIVES

1. To describe the science of nutrition.
2. To describe important facts regarding nutrition.
3. To describe the dietary reference intakes.
4. To describe the major food sources.
5. To describe the recommended energy intake.
6. To define calorimetry and caloric balance.
7. To describe the factors affecting energy expenditure.
8. To describe measurement of BMR.

CONTENTS

1. The science of nutrition.
2. Important facts regarding nutrition.
3. Dietary reference intakes.
4. Major food sources.
5. Recommended energy intake.
6. Calorimetry and caloric balance.
7. Factors affecting energy expenditure.
8. Measurement of BMR.

- The science of Nutrition examines the *qualitative* and *quantitative requirements of the diet* necessary to maintain good health.
- Nutrients are substances that are not synthesized in sufficient amounts in the body and therefore must be supplied by the diet.

NUTRIENTS

Nutrients in the diet can be classified into:

- **Macronutrients:** (carbohydrates , proteins ,fats), which are taken in relatively large amounts to provide fuel for energy.
- **Micronutrients:** (vitamins and minerals), which do not contribute to energy balance but are required in small amounts because they are not synthesized in the body.

IMPORTANT FACTS

1. Nutrition deals with qualitative as well as quantitative requirements of the diet.
2. Diet must supply enough to energy to power all body functions. Energy requirements differs with: age, gender, status of physical activity and environmental temperature.

IMPORTANT FACTS

3. Twenty different amino acids are needed for protein synthesis. Nine amino acids (essential A,As) must be supplied in the diet.
4. Glucose requirement can be supplied in the form of polysaccharides especially starch.
5. concerning lipid requirements, polyunsaturated fatty acids can not be synthesized in the body and should be supplied in the diet.

IMPORTANT FACTS

6. Vitamins are also essential dietary elements.

Water soluble vitamins are needed as coenzymes.
Ascorbic acid act as antioxidant.

Fat soluble vitamins have several functions. Vitamin A involved in vision , vitamin D mainly maintains plasma Calcium level, vitamin K in clotting mechanism, whereas vitamins A and E have antioxidant properties.

7. Excess diet is associated with a variety of diseases such as obesity, type 2 diabetes, atherosclerotic cardiovascular disease, hypertension and cancer.

Nutrition	Human Need
Amino acids	Histidine, isoleucine, leucine, lysine, methionine (cysteine), phenylalanine (tyrosine), threonine, tryptophan, valine.
Fatty acids	Linoleic acid, arachidonic acid, linolenic acid.
Vitamins :	
Water-soluble	C, Biotin, B12, Folic acid, Niacin, pantothenic acid, B6, B2, B1.
Fat-soluble	A,D,E,K
Minerals:	
Macrominerals	Ca , Cl , Mg ,P ,K , Na
Microminerals	Cr, Cu, I, Fe, Mn, Molybdenum, Selenium, Zinc
Fiber	Required for optimal health
Water	The most critical component of diet.
Energy	Utilization of CHO, Fat and Protein in variable proportions.

DIETARY REFERENCE INTAKES

The dietary reference intakes (DRIs) include the reference values used for dietary planning for individuals:

- 1. Recommended daily allowances (RDAs).***
- 2. Estimated average requirement (EAR).***
- 3. The adequate intake (AI).***
- 4. The tolerable upper level (UL).***

ESTIMATED AVERAGE REQUIREMENT

The Estimated Average Requirement (EAR) is the amount of a nutrient estimated to be adequate for half of the healthy individuals of a specific age and gender.

- The EAR is not an effective estimate of nutrient adequacy in individuals because it is a median requirement for a group; 50% of individuals in a group fall below the requirement and 50% fall above it.
- Thus, a person with a usual intake at the EAR has a 50% risk of an inadequate intake.

RECOMMENDED DIETARY ALLOWANCES

- The Recommended Dietary Allowances (**RDA**) is the average daily dietary intake level that meets the nutrient requirements of nearly all (97–98%) healthy persons of a specific sex, age, life style, or physiological conditions (such as pregnancy or lactation).
- The RDA is the nutrient-intake goal for planning diets of individuals.

ADEQUATE INTAKE

- The adequate intake (**AI**) is set instead of an RDA if sufficient scientific evidence is not available to calculate an EAR or RDA.
- The AI is based on estimates of nutrient intake by a group (or groups) of apparently healthy people that are assumed to be adequate.

TOLERABLE UPPER LEVELS OF NUTRIENT INTAKE

- The tolerable UL is the highest level of chronic nutrient intake (usually daily) that is unlikely to pose a risk of adverse health effects for most of the population.
- Excessive nutrient intake can disturb body functions and cause acute, progressive, or permanent disabilities.
- Data on the adverse effects of large amounts of many nutrients are unavailable or too limited to establish a UL. Therefore, the lack of a UL does *not* mean that the risk of adverse effects from high intake is nonexistent.

MAJOR FOOD SOURCES

Food source	Daily intake (g.)	Energy available (Kcal/g.)	Proportion of the whole energy (%)
Carbohydrates	300-400	4	58
Fat	75-90	9	30
Protein	60-75	4	12

RECOMMENDED ENERGY INTAKE

Category	Age (years)	weight (Kg)	Energy need (Kcal) Mean	Energy need (Kcal) Range
Men	23 - 50	70	2900	2300-3100
Women	23-50	55	2230 (+ 300 "Pregnancy"): <i>(In the Second and Third Trimester)</i> (+ 500 "Lactation")	1600-2400

HEALTHY DIET

10% saturated	}	Fat 30%
10% monosaturated		
10% polysaturated		
	}	Protein 12%
48% complex CHO and naturally occurring sugars	}	CHO 58%
10% Refined and processed sugar		

CALORIMETRY

Calorimetry: It deals with the energy requirement of the body and the fuel value of food which supply the energy.

Calorimetry measures the change in energy of a system, such as the human body, by analyzing the heat exchange between the system and its surroundings

Calorie: The amount of heat required to raise the temperature of 1g of water 1°C (from 14.5-15.5 °C).

1000 cal = 1 kilocalorie (kcal)= 1 Cal

kcal = 4.184 kilojoule (kj)

= 4.2 kj

Caloric Balance:

- Energy intake must equal energy expenditure. Energy expenditure varies widely in different conditions.

It is usually more convenient to measure:

Oxygen consumption: 1L of O₂ consumed accounts for approximately 20 KJ (4.83 Kcal) of energy expended.

THE ENERGY EXPENDED BY AN INDIVIDUAL DEPENDS ON 4 MAIN FACTORS:

1. BMR (BEE):

- Is the energy expenditure necessary to maintain basic physiological functions under standardized environment.
- The subject should be at least, awake, and in a warm environment, and measurement should be taken at least 12 hrs after last meal.
- In an adult, the BMR is about 1,800 kcal for men (70 kg) and 1,300 kcal for women (50 kg).
- From 50–70% of the daily energy expenditure in sedentary individuals is attributable to the BMR.

THE ENERGY EXPENDED BY AN INDIVIDUAL DEPENDS ON 4 MAIN FACTORS:

1. BMR (BEE):

BMR is higher in:

1. Males than females.
2. Young children.
3. Fever.
4. Hyperthyroidism.

BMR is lower in:

1. Hypothyroidism.
2. Starvation.

THE ENERGY EXPENDED BY AN INDIVIDUAL DEPENDS ON 4 MAIN FACTORS:

2. Thermogenic effect of food:

Is equivalent to about 5-10% of total energy expenditure (EE) and is attributed to the EE due to digestion and to any stimulation of metabolism caused by influx of new substrates.

3. Physical activity:

Is the largest variable affecting EE. The range is over 10 fold between resting and maximal athletic training.

4. Environmental temperature:

Low temp causes an increase in EE.

MEASUREMENT OF BASAL METABOLIC RATE (BMR)

$$\underline{BMR} = \underline{weight\ (kg)} \times \underline{24\ (Cal/kg)}$$

Energy requirements for activity in the healthy adult

Activity	% of BMR
Sedentary	30
Moderately active	40
Active	50

ENERGY NEEDS IN VARIOUS DAILY ACTIVITIES

Type of Activity	Energy (kcal/h)
Lying sitting/awake	7
Eating	28
Driving	63
Dish washing	70
Typing	70

ENERGY NEEDS IN VARIOUS SPORT ACTIVITIES

Type of Activity	Energy (kcal/h)
Walking 3 miles/h	140
Bicycling $\approx$ 8 miles/h	175
Running	490
Swimming	553

ENERGY REQUIREMENTS FOR ACTIVITY DURING DIFFERENT CONDITIONS

Condition		% of BMR
Ambulatory		20 %
Bed rest:	1. Following injury or trauma	25 %
	2. Following Surgery	20 %
	3. Following non-surgical illness	10 %
Severe infectious illness		35 %
Recovery from serious burn	Depends of burn surface area)	50-300 %