# Normal Nutrition and Diet

I. Nutrition and Human Health

# New Directions

- Advances in nutrition preventing deficiency diseases

- Advances in biotechnology have influenced food supply

- Technologies have raised concerns:
  - Genetically altered food
  - Promote agriculture
  - Conserve natural resources
  - Reduce air and water pollution
  - Support farmer’s markets

- Functional Foods
  - Defiiniton – foods that appear to have a health benefit over and above any known nutrients they contain.

  - Examples:
  - Phytoestrogens
  - Phytochemicals

# Food and lifestyle changes

- Dictate information needed by consumers
- Female vs male roles
- Buffets
- 15-20 min meals
- Herbs, supplements

# Nutrition and Health Promotion

- Major Goal
  - Prevent and control chronic diseases
- Improvement of sanitation

- Death, disability and chronic diseases

- Leading causes of death in the U.S.
  - Heart disease
  - Cancer
  - Stroke

- Definition of health
  - Not just absence of disease
  - Achieve optimum health status and delay chronic health problems

# Science of Nutrition

- 2 Fundamental areas of science
  - Physical sciences
    - Biochemistry
    - physiology
  - Behavioral sciences

- Nutrients
  - Basic currency of nutrition
  - Chemical compounds or elements that participate in chemical reactions
  - Substances needed for growth, repair and maintenance of the body

- Human physiology
  - Homeostasis
  - Molded by behavioral sciences
    - Comes from our earliest awareness
    - Develop throughout the life span

- Perception of self
  - What we eat
  - How we eat
  - Why we eat

# Food and nutrients

- Nutrition
  - Refers to nourishment that sustains life
  - Not only physically, but socially and personally
  - Energy needed to carry out vital functions

- Definitions:
  - Nutritional science
  - Dietetics
  - Registered dietician
  - Public health nutritionist
  - Dietary Reference Intakes

- Nutrients cont.

- Essential
  - Macronutrients
  - Micronutrients

- Water is the often forgotten vital nutrient

- Metabolism – the sum of chemical processes in the body that use nutrients to sustain life and health

- Energy Sources
  - Carbohydrates (CHO)
  - Fats
  - Proteins

  - Calories are synonymous with energy

- Kilocalorie
  - Amount of energy required too raise the temperature of 1 kilogram of water 1 degree celsius

- Energy Requirements
  - Are the total calories needed to maintain body process or resting energy expenditure (REE)

- REE increases during
  - Growth
  - Pregnancy
  - Lactation
  - Fever

- Empty calories
  - Foods that supply calories with little or no nutrients
  - E.g., candy soft drinks alcohol sugar

# Carbohydrates

- Primary source of energy
- Contain C, H and O
- Can be simple (sugars) or complex (starches)
- 80 % of daily calories come from complex CHO
- Provide 4C per gram

- Simple CHO – glucose (simple) is the body's major source of energy.

- The stored source of energy is glycogen also called animal starch (complex)

# Digestion of Carbohydrates

- Begins in the mouth

- End products of CHO digestion:
  - Glucose
  - Fructose
  - Galactose

# Fats

- Come from animal and plant sources
- Provide heat and storage
- Equals 9C/gram
- Should consist of unsaturated and saturated fats

# Proteins

- Use dietary or tissue protein when supply of CHO and fats are insufficient
- Yields 4C/gram
- Can be used for energy but primary function is tissue building

# Tissue building

- Primary nutrient protein
- Amino acids are building blocks of protein come from dietary protein
- Minerals have numerous functions (building tissue)
  - Calcium
  - Phosphorus
  - cobalt

- Vitamins' role in tissue building
  - Vitamin C
  - Vitamin A

# Metabolic regulation & control

- All biochemical processes must be controlled to maintain a physiological system
  - Minerals
  - Vitamins
  - Water

# Nutritional Status

- General nutritional health depends on:
  - Living situation
  - Available food supply
  - Health

- Ideal nutritional status
  - Goal as health professionals
  - Well developed body
  - Ideal weight for height
  - Appropriate body composition/muscle tone

- Borderline nutritional status
  - Also called marginal
  - Meeting minimum needs
  - Lack nutrition reserves to:
    - Meet demands
    - Sustain fetal development
    - Attain proper growth

- Exist in people:
  - Poor eating habits
  - Stressful environments
  - Low incomes
  - Poor quality diets

- Malnutrition
  - Reserves depleted
  - Intake not sufficient to meet needs
  - People live in:
    - High risk conditions/poverty
    - Diets lacking quality/ quanity

- Individuals most vulnerable:
  - Infants
  - Children
  - Pregnant women
  - Elderly adults

- Overnutrition
  - Overweight and obesity
  - Excess intake ; decreased activity
  - Form of malnutrition
  - Increased risk for chronic diseases
  - Growing concern in children

# Nutrition policy and national health problems…….

- Diet, nutrition and chronic disease
  - Improvements in sanitation
  - Discovery of antibiotics
  - Decline in # deaths from infectious diseases
  - Increases in chronic diseases as people age

Chronic health problems

- Coronary heart disease
- Hypertension
- Cancer
- Diabetes
- Pulmonary disease
- Obesity
  - Lead to rise in health care costs

- Major policy changes:
  - Surgeon general's report
  - National research council
    - implications
  - Healthy people 2010
    - Developed public health initiatives

# Nutrition guides for health promotion

- Shifted from preventing primary disease to controlling chronic diseases
- Nutrition guides classified into 3 groups:
  - Nutrition standards
  - Food guides
  - Dietary guidelines

- Nutrient standards
  - Also called energy standards
  - Called RDA's (recommended dietary allowances)

- Food group guides
  - Food pyramid
  - Exchange lists

- Food patterns
  - Personal perceptions influenced by:
    - Ethnic background
    - Cultural or religious beliefs
    - Family habits
    - Socioeconomic status
    - Health status
    - Available food
    - Personal likes/dislikes

- Nutritional analysis
  - E.g., computer programs

# Carbohydrates

- Nature of carbohydrates
  - Made of C, H, O
  - Classified as simple or complex
  - Function to provide energy
  - Forms
    - Starches and sugars

- Photosynthesis

# B. Classification

- Monosaccharides
  - Simple form of CHO
  - Called simple sugar
  - 3 main monosaccharides
    - Glucose
    - Fructose
    - Galactose

- Glucose (Dextrose)
  - Moderately sweet sugar
  - Created from digestion of starch
  - Form that circulates in bloodstream

- Normal Glucose 70- 110 or 80-120 mg/dl.

- Hyperglycemia - elevated blood glucose level
- Hypoglycemia – decreased blood glucose level

- Fructose
  - Sweetest of simple sugars
  - Found in fruits (honey)
  - DO NOT give infant <1yr (botulism)

- Galactose
  - Not found free in foods
  - Produced in human digestion
  - Lactose (milk sugar) converted to glucose in the liver
  - Reaction reversible in lactation

- Disaccharides
  - Double sugars
  - Two monosaccharides linked together
    - Sucrose
    - Lactose
    - maltose

- Sucrose
  - Table sugar
  - Most prevalent dissacharide
  - Found in:
    - All forms common sugar
    - Molasses
    - Fruits/vegetables
    - Peaches/carrots

- Lactose
  - Milk sugar
  - Least sweet of disaccharides
    - Milk sours changes form
    - Solid curd processed for cheese

- Lactose intolerant
  - Sign and symptoms
    - Gas
    - Cramping
    - Bloating
    - Stomach rumbling (borborygmi)
    - Altered bowel habits

- Maltose
  - Occurs in commercial malt products
  - Formed by breakdown of starch
  - Found in grain cereals

- Sugar alcohols
  - Form of CHO
  - Receiving increased attention
  - Found in nature and prepared commercially
  - E.g., sorbitol and xylitol

  - Advantages of sugar alcohols

- Polysaccharides
  - More complex CHO
  - Most important STARCH
  - Other forms
    - Glycogen
    - dextrins

- Sources of starch

  - Starch grains encased in tough covering that is broken down during digestion

- Cooking starches speeds up digestion
- Enzymes in saliva act on cooked starch little effect on raw starch
- Must be broken down into glucose before it can be used

- Dextrins
  - Polysaccharide compounds formed as intermediate products in the breakdown of starch

- Glycogen
  - Animals stored as CHO
  - Plants stored as tystarch
  - Stored in liver and muscle
    - Liver stores help sustain normal glucose during fasting
    - Muscle stores used during athletic activity

# Dietary Fiber

- Known as roughage
- Part of plant resistant to digestion
- Some broken down by bacteria in colon

- Sources:

- Insoluble
  - Holds water
  - Increases stool bulk
  - Prevents constipation
  - Helps lower high cholesterol levels
  - Improves glucose tolerance in diabetics
  - Aids in weight reduction

# III. Lipids (fats)

- Health problems
  - 2 main issues
    - Too much dietary fat
    - Too much fat from animal sources

- Amount of fat
  - Provides excess calories
  - Excess calories stored as adipose tissue
  - Associated with health problems

- Type of fat
  - Increased saturated fat from animal sources results in atherosclerosis
  - Other lipids e.g., olive oil reduce the risk of heart disease and stroke.

- Fat
  - Gives flavor and texture to food
  - Mostly triglycerides (3 fatty acids & 1 glyceride
  - Major function is to provide energy
  - Carries fat soluble vitamins in the body
  - Cushions major organs
  - Insulates body
  - Provides satiety

- Fats (continued)
  - Don’t dissolve in water
  - Digestion occurs in the small intestine
  - 2 types
    - Hidden
    - Visible

- Fatty Acids
  - State of saturation gives lipids texture
  - Saturated
    - harder
  - Unsaturated
    - Softer
    - Usually liquid oils at room temperature

- 3 degrees of saturation
  - Saturated
    - Hydrogenation
    - Trans Fat
  - Monosaturated
  - Polysaturated

# Characteristics of Fatty Acids

- Essential
  - Must be obtained from diet
  - Body can not manufacture it
  - Linoleic acid
  - Linolenic acid
- Non essential
- Functions of fatty acids

# Triglycerides

- Are storage forms of fatty acids
- Occur in body as oily droplets
- Circulate in the water based blood serum encased in a covering of water soluble proteins
- Lipid protein complexes are called lipoproteins

# Cholesterol

- Is a lipid related compound
- Not a fat or triglyceride
- Travels in the bloodstream attached to a fatty acids –cholesterol esters
- Belongs to a family of substances called steroids or sterols
- Body makes more than 2X amt. of cholesterol in american diet

# lipoproteins

- Types
  - High density
    - Good cholesterol
  - Low density
    - Bad cholesterol
    - Methods/sources to increase and decrease

# Proteins

- Foundation of every body cell
- Only nutrient that builds and repairs tissue

- Dietary deficiency of protein result in:

- Digestion of protein
  - Starts in the stomach
  - Enzyme pepsin~polypeptides
  - Small intestine~pancreatic juices~trypsin~ amino acids
  - Must be broken down to amino acids before they can be used

# Amino Acids

- Building blocks of protein
  - Amino~ base~ alkaline
  - Acid~acid~acetic
  - # of amino acids
    - Essential
    - Non-essential

- Structure of amino acids

  - Joining of amino acids= peptide bond

# Types of proteins

- Myosin
- Collagen
- Hemoglobin
- Albumin
- Special roles

- Complete protein foods

- Incomplete protein foods

- Both the type of protein we eat and the amount may influence our risk of chronic disease

# Functions of Protein

- Growth tissue building /maintenance
- Specific physiological roles
- Energy metabolism

- Digestion of protein
  - Mouth – chewing-saliva- semi-solid mass
  - Stomach – chief digestive function; partial enzymatic breakdown
    - 3 gastric secretions help with this function
    - Pepsin
    - Hydrochloric acid
    - rennin

- Pepsin
- Gastric Hydrochloric acid
- Rennin – don’t confuse with renin
  - Important for infants digestion of milk

- Small intestine – begins with acid in stomach; completed in alkaline medium of small intestine
- Pancreatic secretions- 3 enzymes
  - Trypsin
  - Chymotrypsin
  - carboxypeptidase

- Intestinal secretions
  - Aminopeptidase
  - Dipeptidase

- Absorption of amino acids
  - Active transport
  - Hydrolysis
  - Metabolism
    - Anabolism
    - Catabolism
    - Homeostasis

# Protein requirements

- Americans 2-3 X what they really need
- Major health concern in developing countries
- Most comes from animal sources

- High protein diets
  - Creates problems
  - Obesity
  - Vascular disease
  - Burden on kidneys
  - Increases serum insulin levels
  - Bone loss (women)

- Low protein diets
  - Severe malnutrition
  - Clinical situations where beneficial
    - Parkinson's disease
    - Renal failure

# Factors influencing protein requirements

Tissue Growth

- growth increases
- age
- body size
- general physical state
- fetal growth
- pregnancy

- Diet
  - Need for non-protein foods
  - Digestability and absorption
  - Time intervals between foods

- State of health
  - Illness or disease
  - Fever increases requirements
  - Trauma/surgery/wound healing
  - Burns
  - Critical illness
  - Anorexia/ immobilization

Measurement of protein requirements

no need for amino acid supplements

costly and inefficient

# F. Vegetarian Diets

- 3 types
  - Ovolactovegetarian
  - Lactovegetarian
  - Vegan

  generally necessary to consume larger amts. of veg. protein foods to obtain comparable amounts of amino acids

- Benefits of vegetarian diet
  - Less likely to develop hypertension
  - Lower risk of coronary heart disease
  - High in vitamins and minerals
  - High in phytochemicals
  - Decreased incidence of colorectal CA

# V. Energy balance & weight reduction

- 4 basic forms
  - Chemical
  - Electrical
  - Mechanical
  - Thermal

# Energy measurement

- Kilocalorie
- Joule
  - Calorimetry
  - Calculation of approximate composition

# Energy Requirements

- Depend on:
  - Basal metabolic rate
    - Resting metabolic rate
  - Food intake
    - thermic effect of food (TEF)
  - Physical activity
    - Exercise, mental
    - Mental concentration
    - Emotional states

# Energy expenditure

- Overweight
- Energy imbalance
- Excess input over output

- thermogenesis

# Health and Body weight

- Ideal body weight (healthy)
- Body mass index

# C. Body Composition

- Body weight vs. body fat
  - Obesity
  - 20lbs or more over so called standard weight.
  - Metropolitan Life Insurance Co.
  - Updated in 1983
  - Indicates body wt. should not increase beyond age 20 - 30

- The four compartment model of body composition:
  - 1. lean body mass – 30 65% total body weight
  - 2. body fat – male (14-28%) female (15 – 28%) ½ found in subcutaneous fat layers

- 3. Body water – 50-65% body wt. lean muscle tissue > water than other tissues except blood.

- 4. bone – major mineral component is calcium 4-6% total body water

- Factors that influence general body composition:
  - Gender
  - Age
  - Physical exercise
  - Race
  - Climate
  - Weight extremes

- Obesity
  - Greater risk for
    - Cardiovascular disease
    - Hyperlipidemia
    - Diabetes
    - Hypertension
    - Surgical complications
    - Pregnancy complications

- Generalization that fat must be controlled
  - Prevented or treated with drugs/surgery
  - Cause long term damage
  - Result on loss of self esteem

Overweight persons

limited resource family/increased health risks

less access to healthy food

hazardous environmental conditions

inadequate health care

Need to look at fitness level as well

- 1. Health Implications of Obesity
  - Hypertension, hypercholesterolemia, diabetes
  - Coronary heart disease
  - Cancer

- 2. Treatments
  - Early interventions
  - Counseling
  - Social pressures
  - Girl Scouts

- Lead to eating disorders
  - Anorexia Nervosa
  - Bulimia Nervosa
  - Binge eating disorder

- E. Weight Management
  - $$$ spent

- Types and causes of obesity
  - A. Genetic Mobility Factors
  - B. Psychologic Factors
  - C. Social Factors
  - D. Physiologic Factors

## Approaches to Loss

- Popular diets
- Fasting and liquid diets
- Special Gimmicks
  - PPA
  - Ephedra
  - Chitosan
- Pharmacologic Approaches

- Surgery
  - 1. Gastroplasty
  - 2. Gastric and jejunal bypass
  - 3. Cosmetic
    - liposuction

- F. Underweight
  - State of less than adequate weight
  - May be assoc. with poverty/poor living conditions
  - Resistance to infection
  - Strength is reduced
    - General Causes
      - Wasting disease
      - Poor food intake

# Vitamins

- Substance that is not energy producing
- Required in small quantities
- Cannot be manufactured by the body
- Must be supplied in food

- Classification
  - Fat soluble A,D,E,K
    - Can be stored
  - Water soluble C and B complex
    - Easily absorbed and transported
    - Cannot be stored
    - Function mainly as coenzymes

- Fat soluble
  - Vitamin A
    - Specific functions in the retina of the eye
    - Chemical name retinol

- 2 basic dietary forms of Vitamin A
  - Preformed vitamin A – retinol
    - Found in animal food sources
    - Usually associated with fats
    - Dietary sources:
  - Provitamin A – betacarotene
    - Plants cannot synthesize Vit. A produce a compound called carotenoids
    - Found in plants that animals have eaten

- Sources of betacarotene:
- Yellow and orange pigments of carrots and other vegetables and fruits.

- Substances that aid the absorption of vitamin A:
  - Bile salts
  - Pancreatic lipase
  - Dietary fat

# Functions of Vitamin A

- Visual adaptation to light and darkness

- Deficiency:
  - Nightblindness
  - Can be cured in 30 minutes by an injection of Vitamin A

- Signs and symptoms
  - Xerophtalmia – excessive drynes of cornea leads to blindness
  - Respiratory tract dryness
  - Decreased GI secretions
  - Increased UTI
  - Skin changes
  - Altered tooth formation
  - Reproductive changes

- Vitamin A toxicity
  - Hypervitaminosis A
  - s/s toxicity
    - Joint pain
    - Thickening of long bones
    - Loss of hair
    - Jaundice
    - Liver damage ascites
    - Congenital malformations

# Vitamin D

- Significant form is cholecalciferol
  - Found in fish liver oil, fortified milk, and diary products
  - Absorption occurs in small intestine
  - Malabsorption diseases hinder absorption
  - Active hormonal form - calcitriol

- Steps for activation of Vitamin D
  - Skin
  - Liver
  - Kidney

# Functions of Vitamin D

- Calcium and phosphorus metabolism
- Controls cell reproduction
- Treatment of leukemia
- Treatment of persistent skin disorders

- Vitamin D deficiency
  - Children – ricketts
  - Adults – osteomalacia

  - s/s of deficiency:
    - Bone pain
    - Weak brittle bones

- Vitamin D toxicity
  - Results from self-administered doses
  - s/s:
    - Progressive weakness
    - Bone pain
    - Hypercalcemia
    - Failure to thrive

- Food sources of Vitamin D:
  - Milk
  - Yeast
  - Fish oils
  - Margarine fortified
  - Some yogurts
  - Some cereals

# Vitamin E

- Important at looking at reproductive responses
- Named tocopherol – “childbirth”
- Known as anti-sterility vitamin
  - Only tested in rats
- Stored in liver and fatty tissue

- Functions of Vitamin E
  - Antioxidant
  - Immune function in elderly
  - Decrease risk of cardiovascular disease and stroke
  - Slow down course of Alzheimers
  - Examining role in rheumatoid arthritis

- Vitamin E deficiency
  - Hemolytic anemia
  - Cells vulnerable to attack/damage
  - s/s associated withfunctions of the nervous system
  - Affects spinal cord fibers – walking
  - Affects retina – changes in vision

- Vitamin E toxicity
  - No toxic effects have been identified
  - Intakes > 1600 to 3000 mg reported fatigue, gastrointestinal disturbances, altered lipoproteins, changes in thyroid function, and interferance with normal clotting

## Food sources of Vitamin E

- Vegetable oils
- Nuts
- Vegetables
- Fruits
- Small amounts found in cereals, dairy products and meats.

- Vitamin K
  - Blood clotting vitamin
  - Major form found in  plants called phylloquinone; another form menaquinones
  - Synthesized by intestinal bacterial flora
  - Stored in the liver excreted rapidly
  - Requires a functioning liver to carry out role

- Malabsorption – any defect in fat absorption will affect absorption of Vit K
- Drug therapy – several drug interactions can inhibit action of Vit. K

- Daily requirements- Newborns given injection
  - Other diseases may require supplements

- Food sources of Vitamin K
  - Highest in green vegetables and in liver
  - Also found in some cheeses
- Toxicity
  - Even with large amounts taken over extended periods of time toxicity has not been observed.