بِسۡمِ ٱللَّهِ ٱلرَّحۡمَٰنِ ٱلرَّحِيمِ

رَبِّ اشْرَحْ لِیْ صَدْرِیْ ○ وَیَسِّرْلِیْ اَمْرِیْ ○
وَ ا حْلُلْ عُقْدَةً مِّنْ لِّسَانِیْ ○ یَفْقَهُوْا قَوْلِیْ ○

اے میرے رب! میرا سینہ کھول دے اور میرے لیے میرا کام آسان کر دے اور میری زبان کی گرہ کھول دے تا کہ لوگ میری بات سمجھ سکیں

رَبِّ زِدْنِی عِلْمًا

MY LORD! INCREASE ME IN KNOWLEDGE.

FST-311. FOOD BIOCHEMISTRY 3(3-0)

L # 37-38. LIPIDS IN FOOD BIOCHEMISTRY-BASICS

B. Sc. (Hons). Food Science and Technology
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Dr. Shahid Mahmood Rana
Associate Professor

INSTITUTE OF FOOD SCIENCE AND NUTRITION (IFSN)

UNIVERSITY OF SARGODHA, SARGODHA-PAKISTAN

LIPIDS: FATS AND OILS

1. TYPES
2. FUNCTIONS
3. DIETARY REQUIREMENTS
4. CONTENT IN FOOD
5. FAT SUBSTITUTES

LIPIDS - INTRODUCTION

- LIPIDS - GROUP OF NATURALLY OCCURRING SUBSTANCES
  - *SOLUBLE IN ORGANIC SOLVENTS*
    - CHLOROFORM
    - DIETHYL ETHER
    - CARBON TETRACHLORIDE
    - PETROLEUM ETHER
  - *INSOLUBLE OR SPARINGLY SOLUBLE*
    - WATER

LIPIDS - INTRODUCTION

"LIPIDS ARE GROUP OF NATURALLY OCCURRING SUBSTANCES SOLUBLE IN ORGANIC SOLVENTS LIKE CHLOROFORM, DIETHYL ETHER, CARBON TETRACHLORIDE, PETROLEUM ETHER AND INSOLUBLE OR SPARINGLY SOLUBLE IN WATER".

LIPIDS AND NUTRITION

TYPES

SIMPLE LIPIDS	Fats
	Oils
	Waxes
COMPOUND LIPIDS	Phospholipids
	Glycolipids
	Lipoproteins
DERIVED LIPIDS	Fatty acids
	Alcohols
	Hydrocarbons

SUBSTANCES ASSOCIATED WITH LIPIDS IN NATURE

Tocopherols
K-vitamins
Steroids

LIPIDS - INTRODUCTION

- CHEMICALLY, LIPIDS CONSIST OF C
  H
  O
- SOME ALSO CONTAIN P & N
- SOME NUTRITIONALLY IMPORTANT LIPIDS
  FATS AND OILS
  PHOSPHOLIPIDS
  GLYCOLIPIDS
  STEROLS
  STEROIDS

FATS AND OILS

SIMPLE LIPIDS

FATS

- SOLID AT AMBIENT TEMPERATURE (Approx: **25** °C)
- CONTAIN 2 OR 3 SATURATED FATTY ACIDS WITH GLYCEROL

OILS

- LIQUID AT AMBIENT TEMPERATURE (Approx: 25 °C)
- HAVE AT LEAST ONE UNSATURATED FATTY ACID WITH GLYCEROL MOLECULE

FATS AND OILS

- CHEMICALLY, ESTERS OF FATTY ACIDS WITH GLYCEROL
- **MONO-GLYCERIDES:** ONE MOLECULE OF FATTY ACIDS + 01 MOLECULE OF GLYCEROL
- **DI-GLYCERIDES**: TWO MOLECULES OF FATTY ACIDS + 01 MOLECULE OF GLYCEROL
- **TRI-GLYCERIDES:** THREE MOLECULES OF FATTY ACIDS + 01 MOLECULE OF GLYCEROL
- MOST FATS AND OILS ARE TRIGLYCERIDES

FUNCTIONS- FATS AND OILS

- SEVERAL ROLES: NUTRITIONAL, FUNCTIONAL, SENSORY
- PROVIDE ENERGY: 9 KCAL OR 37.7 KJ/G
- PROVIDE ESSENTIAL FATTY ACIDS
  - *LINOLEIC ACID*
  - *LINOLENIC ACID*
- CARRY FAT-SOLUBLE VITAMINS
  - *A, D, E, K*
- DISSOLVE FLAVOURS, COLOURS, MAKE FOOD ATTRACTIVE

FUNCTIONS- FATS AND OILS

- MAKE FOOD MORE PALATABLE
- LUBRICATE FOOD MAKING EASIER TO SWALLOW
- PROVIDE FEELING OF SATIETY
- PROVIDE:
  - *FATTY ACIDS*
  - *CHOLESTEROL: FORM CELL MEMBRANES IN ALL BODY ORGANS*
- HELP FORMATION OF:
  - *RETINA*
  - *CENTRAL NERVOUS SYSTEM*

FATS AND OILS – FUNCTIONS

- STORED FAT IN BODY
  - *SERVE AS ENERGY RESERVE*
  - *PROTECT ORGANS (HEART, KIDNEY, VISCERA) FROM SHOCK AND INJURY*
- HELP MAINTAIN CONSTANT BODY TEMPERATURE BY PROVIDING INSULATING LAYER UNDER SKIN
- CONTRIBUTE TO BODY SHAPE

FATTY ACIDS

- CHAIN OF CARBON ATOMS, EACH WITH HYDROGEN ATOMS ATTACHED
- CHAIN ENDS IN ACIDIC GROUP (--COOH)
- --COOH ABLE TO COMBINE WITH GLYCEROL
- DOZENS OF FATTY ACIDS IN NATURE

FATTY ACIDS

- FAs DIFFER IN
  - *NUMBER OF CARBON ATOMS*
  - *DOUBLE BONDS*
- CLASSIFIED ON THE BASIS OF
  - *CHAIN LENGTH*
  - *CHEMICAL STRUCTURE*
  - *NUTRITIONAL REQUIREMENTS*

CLASSIFICATION: CHAIN LENGTH

SHORT CHAIN FATTY ACIDS

- CONTAIN ≤ 8 CARBON
- LOW MELTING POINT
- MORE EASILY DIGESTED THAN LONG CHAIN FATTY ACIDS

EXAMPLES:

- ACETIC (C-2)
- BUTYRIC (C-4)
- CAPROIC (C-6)
- CAPRYLIC ACIDS (C-8)

CLASSIFICATION: CHAIN LENGTH

LONG CHAIN FATTY ACIDS

- CONTAIN ≥ 10 CARBON ATOMS
- MELTING POINT RISES AS CHAIN LENGTH INCREASES

EXAMPLES

- CAPRIC ACID (C-10)
- MYRISTIC ACID (C-14)
- PALMITOLEIC ACID (C-16)
- OLEIC ACID (C-18)
- LINOLENIC ACID (C-18)
- ARACHIDIC ACID (C-20)
- ARACHIDONIC ACID (C-20)
- LAURIC ACID (C-12)
- PALMITIC ACID (C-16)
- STEARIC ACID (C-18)
- LINOLEIC ACID (C-18)

CLASSIFICATION: CHEMICAL STRUCTURE

SATURATED FATTY ACIDS

- GENERAL FORMULA $C_nH_{2n}O_2$ OR $C_nH_{2n+1}.COOH$
- CONTAIN MAXIMUM NUMBER OF HYDROGEN ATOMS THEIR CHEMICAL STRUCTURE WILL PERMIT
- HAVE NO DOUBLE BONDS IN THEIR STRUCTURE
- QUITE STABLE
- HIGHER MELTING POINT
- ANIMAL FATS, HYDROGENATED FATS - CONTAIN MORE SATURATED FATTY ACIDS THAN PLANT AND FISH OILS

CLASSIFICATION: CHEMICAL STRUCTURE

SATURATED FATTY ACIDS – CONT…

- LAURIC, MYRISTIC AND PALMITIC RAISE BLOOD SERUM CHOLESTEROL LEVEL
- OCCUR MOST COMMONLY
- PALMITIC ACID WIDELY DISTRIBUTED, MAY CONTRIBUTE 10–50 % OF TOTAL FATTY ACIDS IN ANY FOOD
- PALMITIC ACID MAKES
  - UP TO 35 % OF ALL FATTY ACIDS IN ANIMAL FATS
  - UP TO 17 % IN PLANT OILS AND FISH

CLASSIFICATION: CHEMICAL STRUCTURE

PALM, PALM KERNEL AND COCONUT OILS:

- CONTAIN MORE SATURATED FATTY ACIDS THAN OTHER PLANT OILS
- INTAKE SATURATED FATTY ACIDS SHOULD NOT PROVIDE MORE THAN 10 % ENERGY

SATURATED FATTY ACIDS: SOURCES

Fatty Acid	Mol. formula	C	Sources
Arachidic	$C_{20}H_{40}O_2$	20	Groundnut Oil
Stearic	$C_{18}H_{36}O_2$	18	Most Fats and Oils
Palmitic	$C_{16}H_{32}O_2$	16	Palm Oil
Myristic	$C_{14}H_{28}O_2$	14	Butter, Coconut
Lauric	$C_{12}H_{24}O_2$	12	Coconut oil
Capric	$C_{10}H_{20}O_2$	10	Coconut oil
Caprylic	$C_8H_{16}O_2$	8	Coconut oil
Caproic	$C_6H_{12}O_2$	6	Butter
Butyric	$C_4H_8O_2$	4	Butter

CLASSIFICATION: CHEMICAL STRUCTURE

UNSATURATED FATTY ACIDS

- GENERAL FORMULA:

$$C_nH_{2n-1}COOH \text{ OR}$$

$$C_nH_{2n-3}.COOH \text{ OR}$$

$$C_nH_{2n-5}.COOH$$

- ONE OR MORE DOUBLE BONDS IN STRUCTURE
- SUSCEPTIBLE TO SPOILAGE - REACT WITH AIR
- LOWER MELTING POINT THAN SATURATED FATTY ACIDS

CLASSIFICATION: CHEMICAL STRUCTURE

- PLANT AND FISH OILS
  - PROPORTIONATELY MORE UNSATURATED FATTY ACIDS THAN ANIMAL FATS
- IN NATURE, OLEIC ACID (18 C ATOMS, ONE DOUBLE BOND) MOST COMMON
  - MOST FATS CONTAIN 30 TO 65 % OF THEIR TOTAL FATTY ACIDS AS OLEIC

UNSATURATED FATTY ACIDS

- MONOUNSATURATED FATTY ACIDS HAVE NO EFFECT ON BLOOD CHOLESTEROL
- POLYUNSATURATED FATTY ACIDS
  - TWO OR MORE DOUBLE BONDS
  - HELP REDUCE BLOOD CHOLESTEROL LEVEL
- LESS EFFECTIVE IN REDUCING CHOLESTEROL THAN SATURATED FATTY ACIDS IN RAISING

UNSATURATED FATTY ACIDS

- LINOLEIC ACID (C 18, 2 DOUBLE BONDS) ABUNDANT IN PLANT OILS
- COTTON SEED, GROUNDNUT, SOYBEAN, CORN, SUNFLOWER AND SAFFLOWER OILS CONTAIN
  - 70 TO 91 % POLYUNSATURATED FATTY ACIDS
  - ONLY 9 TO 26 % SATURATED FATTY ACIDS

UNSATURATED FATTY ACIDS & SOURCES

Fatty Acids Source	Mol.	C	double bond &
• Caproleic	$C_{10}H_{18}O_2$	10	1 Butter fat
• Lauroleic	$C_{12}H_{22}O_2$	12	1 Butter fat
• Myristoleic	$C_{14}H_{26}O_2$	14	1 Butter fat
• Palmitoleic	$C_{16}H_{30}O_2$	16	1 Fish oils, beef
• Oleic	$C_{16}H_{30}O_2$	18	1 Most fats, oils
• Elaidic	$C_{18}H_{34}O_2$	18	1 Butter fat

EXAMPLES: UNSATURATED FATTY ACIDS & SOURCES

• Vaccenic	$C_{18}H_{34}O_2$	18	1	Butter fat
• Linoleic	$C_{18}H_{32}O_2$	18	2	Most veg oils
• Linolenic	$C_{16}H_{30}O_2$	18	3	Soybean, Canola
• Cadoleic	$C_{20}H_{38}O_2$	20	1	Some fish oils
• Arachidonic	$C_{20}H_{32}O_2$	20	4	Lard
• Erucic	$C_{22}H_{42}O_2$	22	1	Canola, rapeseed

NUTRITIONAL CLASSIFICATION

ESSENTIAL FATTY ACIDS

CANNOT BE SYNTHESISED IN HUMAN BODY

- MUST BE PRESENT IN DIET TO PROVIDE UP TO ABOUT 3 % ENERGY INTAKE

PRECURSORS FOR GROUP OF HORMONE-LIKE COMPOUNDS

  - REGULATE VARIETY OF PHYSIOLOGICAL FUNCTIONS

NUTRITIONAL CLASSIFICATION

- NEEDED FOR:
  - CELL MEMBRANES IN ALL ORGANS OF BODY
  - DEVELOPMENT OF RETINA
  - DEVELOPMENT OF CENTRAL NERVOUS SYSTEM
  - PROPER GROWTH IN CHILDREN ESPECIALLY:
    - BRAIN DEVELOPMENT
    - MATURATION OF SENSORY SYSTEMS

ESSENTIAL FATTY ACIDS CONT…

- LINOLEIC ACID, LINOLENIC ACID - ESSENTIAL
- LINOLEIC ACID -18 C, 2 DOUBLE BONDS
  - OMEGA-6 FATTY ACID
  - FOUND IN CORN AND SOYBEAN OILS
  - PRECURSOR OF OTHER OMEGA-6 FATTY ACIDS
  - INDISPENSABLE FOR GROWTH AND MAINTENANCE OF NORMAL SKIN
  - CONVERTED INTO GAMMA-LINOLENIC ACID IN HUMAN BODY

ESSENTIAL FATTY ACIDS

- **LINOLEIC ACID**
- DEFICIENCY VERY RARE
- DEFICIENCY IN INFANTS GIVES RISE TO ECZEMA
  - DRY THICKENED AND SCALY SKIN WITH OOZING INTO BODY FOLDS
  - CHANGES IN HAIR TEXTURE

ESSENTIAL FATTY ACIDS

- LINOLENIC ACID (18 C, 3 DOUBLE BONDS)
  - OCCURS IN SMALL AMOUNTS IN VEGETABLE OILS, ESPECIALLY LINSEED (FLAXSEED, *ALSI*)
  - OMEGA-3 FATTY ACID
  - HELPS IN FORMATION OF CELL MEMBRANES, MAKES THEM FLEXIBLE

ESSENTIAL FATTY ACIDS

- IMPROVES CIRCULATION AND OXYGEN UPTAKE
- AT LEAST 1 % ENERGY INTAKE BE FROM LINOLENIC ACID – USEFUL IF MORE, UPTO 3 %
- DEFICIENCY RARE
  - SKIN BECOMES FLAKY, ITCHY
  - RETARDATION OF WOUND HEALING
  - DEVELOPMENT OF ANAEMIC CONDITIONS

NUTRITIONAL CLASSIFICATION

NON-ESSENTIAL FATTY ACIDS

- EXCEPT LINOLEIC AND LINOLENIC ACIDS - ALL FATTY ACIDS CONSIDERED AS NON-ESSENTIAL
- AVAILABLE IN ABUNDANT QUANTITIES IN FOODS OF:
  - ANIMAL ORIGIN
  - PLANT ORIGIN
- IF DEFICIENT, CAN BE SYNTHESISED IN BODY

SOURCES OF FATS AND OILS IN THE DIET

PLANT SOURCES

- SEEDS OF SOME PLANTS
- OIL FROM OILSEEDS OBTAINED BY:
  - EXTRACTION - SOLVENT EXTRACTION USING HEXANE
  - EXPRESSION
- ALL PLANT OILS CONTAIN MORE UNSATURATED FATTY ACIDS EXCEPT PALM, PALM KERNEL AND COCONUT OILS

CLASSIFICATION OF PLANT OILS

- BASED ON DOMINANCE OF CERTAIN FATTY ACIDS - FOUR GROUPS:
- LINOLENIC ACID GROUP
- OILS HAVE APPRECIABLE AMOUNT OF LINOLENIC ACID
- MAY ALSO CONTAIN OLEIC AND LINOLEIC ACIDS
- SOYBEAN OIL - CONTAINS 7 % LINOLENIC ACID AND 54 % LINOLEIC

OLEIC-LINOLEIC ACID GROUP

- LARGEST, MOST VARIED IN TERMS OF COMPOSITION AND CHARACTERISTICS OF INDIVIDUAL OILS

EXAMPLES

- COTTONSEED OIL (54 % LINOLEIC ACID)
- OLIVE OIL (8 % LINOLEIC AND 1 % LINOLENIC ACIDS)
- PALM OIL (10 % LINOLEIC ACID)
- PEANUT OIL (34 % LINOLEIC ACID)
- SAFFLOWER OIL (78 % LINOLEIC ACID)
- SUNFLOWER OIL (69 % LINOLEIC ACID)

LAURIC ACID GROUP

- LEAST UNSATURATED OF ALL COMMERCIAL EDIBLE OILS
- PREDOMINANTLY CONTAIN LAURIC ACID
- CONTAIN SATURATED FATTY ACIDS WITH 8, 10, 14, 16 AND 18 CARBON ATOMS
- EXAMPLES:
  - *COCONUT OIL - 90 - 94 % SATURATED FATTY ACIDS*
  - *PALM KERNEL OIL – 83 % SATURATED FATTY ACIDS.*

ERUCIC ACID GROUP

- CHARACTERISED BY PRESENCE OF HIGH QUANTITIES OF ERUCIC ACID (40 – 55 %)
- SUSPECTED PHYSIOLOGICALLY HARMFUL - RETARDS GROWTH
- EXAMPLES:
  - MUSTARD OIL
  - RAPESEED OIL
  - CANOLA OIL - MINUTE QUANTITIES.

ANIMAL SOURCES

- INCLUDES LARD AND TALLOW
- LARD - PORK BODY FAT, RENDERED FROM FATTY TISSUES OF HOGS
- TALLOW - CATTLE BODY FAT, OBTAINED FROM CATTLE, LESSER EXTENT, SHEEP AND GOAT
- BOTH HAVE HIGH CONTENT SATURATED FATTY ACIDS AND CHOLESTEROL.
- TALLOW – GENERALLY HEAT RENDERED WITH DRY HEAT OR STEAM

MILK FAT

MILK

- FAT SEPARATED AS CREAM, PREPARE BUTTER
- BUTTER HEAT RENDERED YIELDS ‘GHEE’
- RICH SOURCE OF SATURATED FATTY ACIDS AND CHOLESTEROL
- BUTTER FAT
- MOST COMPLEX OF ALL COMMON FATS
- COMPRISES ABOUT 184 FATTY ACIDS
- CONTAINS CHOLESTEROL
- SATURATED FATTY ACIDS CONTAINED HELP IN SYNTHESIS OF CHOLESTEROL IN THE BODY.

MARINE OILS

- INCLUDE OILS FROM
  - HERRING
  - MENHADEN
  - COD (LIVER)
  - HALIBUT (LIVER)
  - OTHER FISH
- CHARACTERISTICS - PRESENCE OF HIGH PERCENTAGE OF UNSATURATED FATTY ACIDS
- HELPFUL IN LOWERING CHOLESTEROL LEVEL IN BODY.

FST-202. L # 27. LIPIDS DERIVEDCOMPOUNDS

- Visible and Invisible Fats
- Phospholipids
- Glycolipids
- Sterols and Steroids
- Cholesterol

VISIBLE AND INVISIBLE FATS

VISIBLE

- BUTTER, GHEE, MARGARINE, COOKING OILS, FAT ON MEAT
- CONSUMER MAKES SELECTION - EAT MORE OR LESS

INVISIBLE

- MILK, MILK PRODUCTS, NUTS, LEAN MEAT, OTHER ANIMAL AND VEGETABLE FOODS
- NUTRITIONAL SIGNIFICANCE - CONSUMER EATS WITHOUT TAKING INTO ACCOUNT QUANTITY
- ESPECIALLY CALORIE CONSCIOUS PERSONS TO AVOID

PHOSPHOLIPIDS

- PHOSPHOLIPIDS OR PHOSPHATIDES (COMPOUND LIPIDS) FOUND IN EVERY LIVING CELL
- INCLUDE SUBSTANCES CHARACTERISED BY FATTY CHAIN COUPLED TO A PHOSPHATE GROUP
- FORMED FROM GLYCEROL, FATTY ACIDS, PHOSPHORIC ACID AND A NITROGENOUS BASE
- CHOLINE (SYNTHESISED IN THE BODY FROM METHIONINE, AN AMINO ACID) AND SERINE ARE

  – TWO NITROGENOUS BASES FOUND IN PHOSPHOLIPIDS

PHOSPHOLIPIDS - FUNCTIONS

- CONSTITUENTS OF CELL MEMBRANE AND INTRACELLULAR
- STRUCTURES IN COMBINATION WITH PROTEINS
- INCORPORATED INTO MYELINE LAYER AROUND NERVE FIBRES:
  - AN INSULATOR
  - PREVENTS LEAKAGE OF NERVOUS IMPULSES
- CONCERNED WITH TRANSPORT OF FAT IN BLOOD STREAM

TYPES OF PHOSPHOLIPIDS

NUMEROUS PHOSPHOLIPIDS

ONLY TWO OF NUTRITIONAL SIGNIFICANCE

- LECITHIN
- SPHINGOMYELINS

PHOSPHOLIPIDS

LECITHIN

- RESPONSIBLE FOR FAT TRANSPORTATION
- SYNTHESISED FROM:
  - METHIONINE CONVERTED TO CHOLINE
  - SUGARS OR FATS - TO MAKE FATTY ACIDS AND GLYCEROL
  - PHOSPHORUS

PHOSPHOLIPIDS - LECITHIN

- SOURCES
  - EGG YOLK RICHEST (UP TO 10 % BY WEIGHT)
  - YEAST
  - SOYBEAN
  - WHEAT GERM
  - ANIMAL TISSUES (LIVER)
- COMMERCIALLY USED IN FOOD INDUSTRY AS EMULSIFIER IN PRODUCTS LIKE MAYONNAISE.

PHOSPHOLIPIDS

SPHINGOMYELINS

- CONTAIN:
  - SPHINGOSINE (COMPLEX AMINO ALCOHOL)
  - CHOLINE (FATTY ACID) AND
  - PHOSPHORIC ACID
- FOUND IN:
  - BRAIN
  - NERVE TISSUE
  - AS PART OF CELL STRUCTURE
  - ALSO PRESENT IN BLOOD.

GLYCOLIPIDS

ALSO COMPOUND LIPIDS

- COMPRISE OF:
  - PHERENOSIN
  - KERASIN
  - FATTY ACIDS
  - SPHINGOSINE AND
  - GALACTOSE – ONLY STRUCTURE OF BODY THAT INCORPORATES GALACTOSE
- CEREBROSIDE - A GLYCOLIPID FOUND IN:
  - WHITE MATTER OF BRAIN AND
  - MYELIN SHEATH OF NERVES.

STEROIDS AND STEROLS

- STERIODS – SOLID
- STEROL – A SOLID ALCOHOL

EXAMPLES

- CHOLESTEROL
- MANY HORMONES EXCRETED BY ADRENAL CORTEX AND GONADS
- CONTAIN SAME BASIC RING STRUCTURE

STEROLS AND STEROIDS

ADRENAL GLANDS

- ONE LYING ABOVE EACH KIDNEY
- ADRENAL CORTEX SECRETES MINERALS AND GLUCOCORTICOIDS

CONTROL

- CHEMICAL COMPOSITION OF BODY FLUIDS
- METABOLISM
- SEXUAL CHARACTERISTICS

STEROIDS

- NATURALLY OCCURRING GROUP OF CHEMICALS ALLIED TO CHOLESTEROL AND INCLUDE
  - SEX-HORMONES
  - ADRENAL CORTICAL HORMONES
  - BILE ACIDS etc.

STEROIDS

NOW IMPLY NATURAL ADRENAL GLUCOCORTICOIDS

- HYDROCORTISONE
- CORTISONE
- SYNTHETIC ANALOGUES SUCH AS PREDNISOLONES AND PREDNISONE
- PREDNISOLONES - SYNTHETIC HORMONE WITH PROPERTIES SIMILAR TO THOSE OF CORTISONE PRESCRIBED FOR CONNECTIVE TISSUE DISEASES, CONDITIONS INVOLVING IMMUNE REACTION
- PREDNISONE - CONVERTED INTO PREDNISOLONE IN LIVER

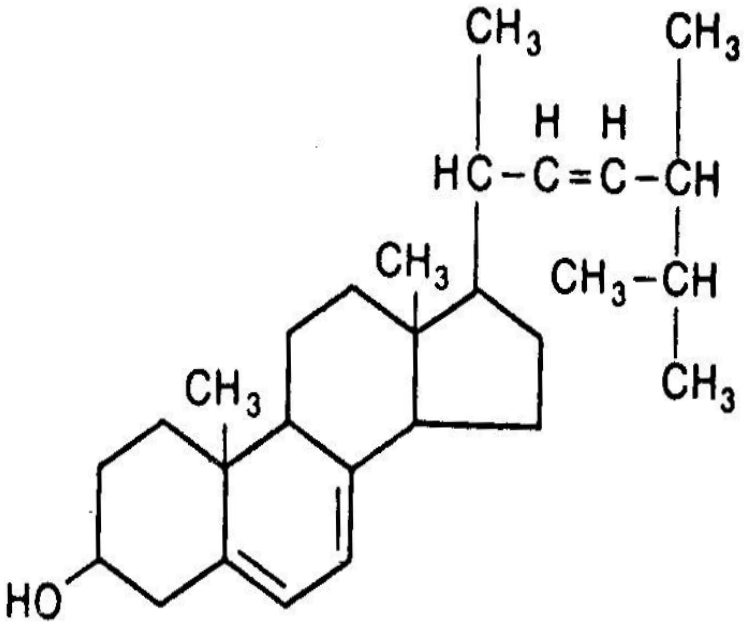
STEROLS AND STEROIDS

HAVE COMMON BASIC STRUCTURE

- STEROLS VARY WIDELY IN PHYSIOLOGICAL FUNCTIONS
- COMMON STEROLS:
  - **CHOLESTEROL**
  - **ERGOSTEROL**
  - **7-DEHYDROCHOLESTEROL**

ERGOSTEROL

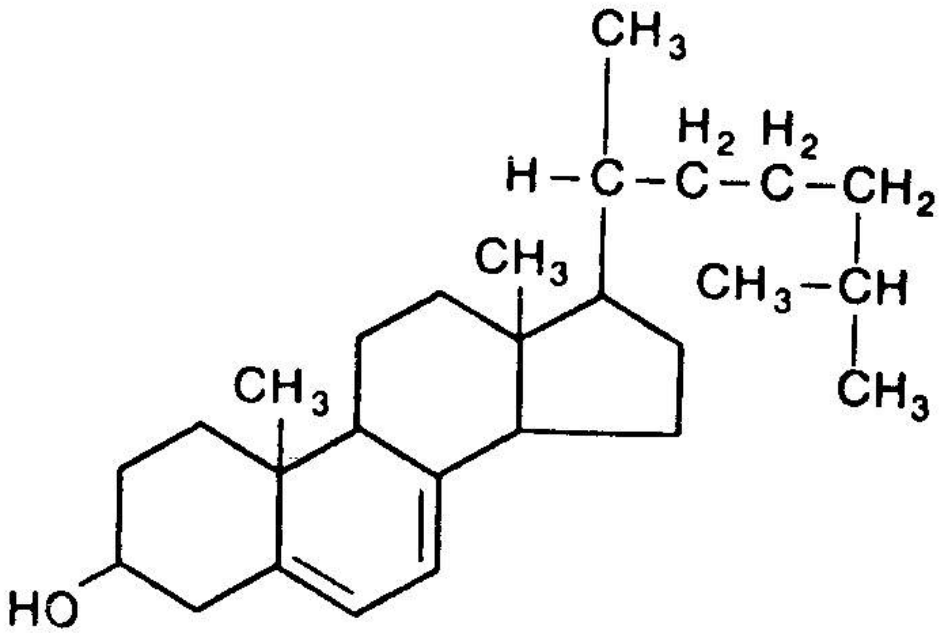
- PLANT STEROL



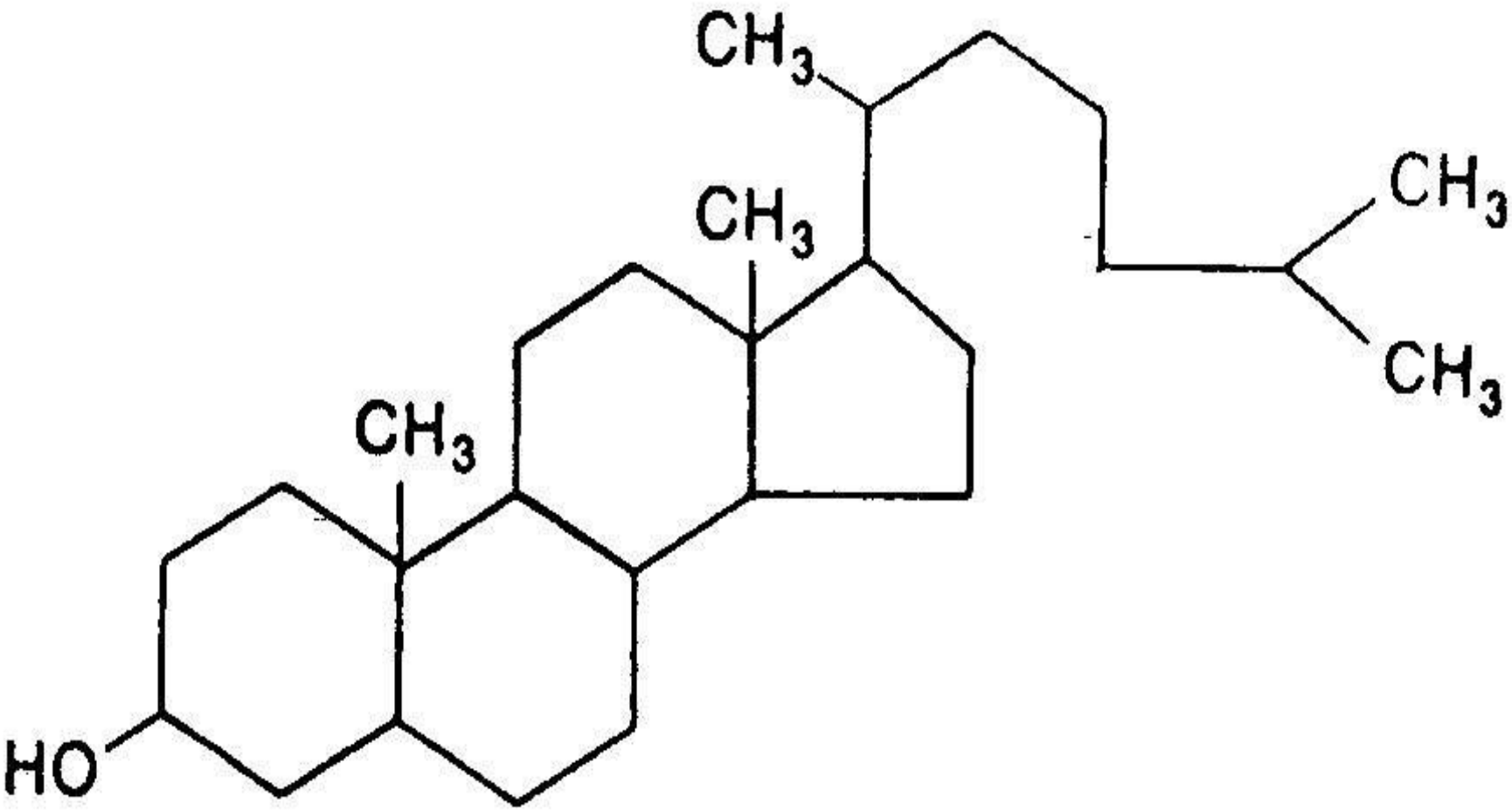
- PRECURSOR OF **VITAMIN D_2 or ERGOCALCIFEROL**

7-DEHYDROCHOLESTEROL

- Animal sterol
- precursor of vitamin D
- When subjected to ultraviolet radiation (sunlight), converted to vitamin D_3 or cholecalciferol



CHOLESTEROL



CHOLESTEROL

- ANIMAL STEROL
- FOUND IN:
  - ALL BODY CELLS
  - ALL BODY FLUIDS
  - BRAIN - ON DRY BASIS
    - WHITE MATTER ABOUT 14 % CHOLESTEROL
    - GREY MATTER 6 %
- MOST HORMONES OF ADRENAL CORTEX DERIVATIVES OF CHOLESTEROL

CHOLESTEROL

- PRECURSOR OF:
- CHOLIC ACID - CONSTITUENT OF BILE ACID
- BEST KNOWN FOR ASSOCIATION WITH:
  - ATHEROSCLEROSIS (HARDENING)
  - CORONARY HEART DISEASE
- DEPOSITS ON INTERIOR OF ARTERIES - HARDENING AND NARROWING.

CHOLESTEROL – BODY SUPPLY

EXOGENOUS

- INDUSTRIALISED COUNTRIES
  - CONSUME MORE FAT
  - AVERAGE INTAKE BETWEEN 500–800 MG CHOLESTEROL PER DAY
- DEVELOPING COUNTRIES
  - AVERAGE INTAKE ABOUT 300 MG CHOLESTEROL PER DAY
  - CONSUME MORE CARBOHYDRATES

CHOLESTEROL – BODY SUPPLY

ENDOGENOUS

- SYNTHESISED IN TISSUES FROM ACETYL COENZYME A - IMPORTANT COMPOUND IN MAJOR METABOLIC PATHWAY
- ABOUT 1500 MG CHOLESTEROL SYNTHESISED IN BODY OF AN AVERAGE ADULT IN A DAY.

CHOLESTEROL - CONTD

- HIGH CHOLESTEROL INTAKE DOES NOT AFFECT SYNTHESIS BY BODY
- INTESTINES CAN ABSORB MAXIMUM AMOUNT OF CHOLESTEROL
- BEYOND THIS, EXCESS EXCRETED IN FAECES
- NORMALLY CHOLESTEROL GAINS FROM BODY SYNTHESIS AND DIET BALANCED BY LOSSES, MAINLY IN BILE.

CONTROLLING BLOOD CHOLESTEROL

- ACCUMULATION OF CHOLESTEROL COMMON WITH:
  - INCREASED AGE
  - REDUCED PHYSICAL ACTIVITY
- RAISED BLOOD CHOLESTEROL LEVEL (ABOVE 150 MG/100 ML PLASMA) MAIN RISK FACTOR IN HEART DISEASE
- WHEN COMBINED WITH OTHER RISK FACTORS LIKE SMOKING, LIKELIHOOD OF DYING FROM HEART DISEASES INCREASES.

CONTROLLING BLOOD CHOLESTEROL

CONSUMPTION OF

– SATURATED FATTY ACIDS	ANIMAL FATS
– EGG YOLK	FATTY MEALS
– FULL CREAM MILK	CHEESE
– CAKES	PASTRIES
– MARGARINE	COCONUT

CONTROLLING BLOOD CHOLESTEROL

INCREASE INTAKE OF

POLYUNSATURATED FATTY ACIDS

- CORN OIL
- FISH OIL

DECREASE BLOOD CHOLESTEROL LEVEL

- LESS EFFECTIVE IN REDUCING CHOLESTEROL LEVEL THAN SATURATED FATTY ACIDS IN RAISING.

CONTROLLING BLOOD CHOLESTEROL

LIBERAL CONSUMPTION OF

- FRUITS, VEGETABLES, SALADS
- WHOLE GRAINS, WHOLE LEGUMES
- SKIM MILK
- VEGETABLE OILS - ESPECIALLY POLYUNSATURATED
- EGG WHITE.

CHOLESTEROL IN FOODS

Very Rich - Over 1000 mg in 100 g

- Brain
- Liver
- Egg yolk
- Kidney
- Butter

Rich – 100 –200 mg/100 g

- Heart
- Most cheeses

Moderate – 50 –100 mg in 100 g

- Beef
- Lamb
- Chicken
- Veal
- Turkey
- Beef fat

CHOLESTEROL IN FOODS

LOW – 30 - 50 MG PER 100G

- ICE CREAM
- YOGHURT

FREE - BELOW 30 MG PER 100 G

- EGG WHITE
- FRUITS
- CEREALS
- LEGUMES
- FISH
- VEGETABLES
- NUTS
- PLANT OILS.

DIETARY RECOMMENDATIONS

- DEVELOPING COUNTRIES:
  - 8-10 % TOTAL ENERGY FROM FATS
- INDUSTRIALISED COUNTRIES:
  - UP TO 45 % ENERGY FROM FATS
- HIGH INTAKES OF FAT, SATURATED FAT, AND CHOLESTEROL ASSOCIATED WITH:
  - OBESITY
  - CARDIOVASCULAR DISEASES
  - CANCERS OF COLON, RECTUM, BREAST AND PROSTRATE

DIETARY RECOMMENDATIONS

- SEDENTARY ADULTS - AVOID TOO MUCH:
  - FAT
  - SATURATED FAT
  - CHOLESTEROL
- CHILDREN IN GROWING STAGE REQUIRE MORE ENERGY
  - REQUIRE CHOLESTEROL TO:
    - BUILD BODY CELLS
    - BUILD BRAIN CELLS
    - BUILD NERVOUS TISSUES.

RDA - FATS

- NO RECOMMENDED DAILY ALLOWANCES FOR FATS
- SUGGESTED:
  - FATS AND OILS BE CONSUMED NOT MORE THAN 30- 40 % TOTAL ENERGY
- WHERE WEIGHT CONTROL IMPORTANT:
  - MAINTAIN BALANCED DIET
  - AVOID EXCESSIVE INTAKE OF FATS AND OILS.

CONTENT IN FOODS

- RICHEST SOURCE
  - FATS AND EDIBLE OILS GROUP
- GOOD SOURCES
  - NUTS AND DRY FRUITS
- POOR SOURCES
  - FRESH FRUITS, VEGETABLES AND TUBERS
- FREE
  - SUGAR, 'GUR‘, HONEY

FAT CONTENT (g / 100 g)

CEREALS AND CEREAL PRODUCTS

- CORN FLOUR, WHOLE 3.9
- CORN FLAKES 0.4
- RICE, POLISHED 1.7
- WHEAT, WHOLE GRAIN FLOUR 1.6
- WHEAT BRAN 3.1
- WHEAT BREAD (CHAPATI) 1.2
- WHEAT BREAD (RAISED) 1.2

FAT CONTENT (g /100 g)

LEGUMES AND PULSES

- CHICKPEA, COOKED 3.8
- LENTIL, COOKED 1.4
- MUNG BEAN, COOKED 0.8

VEGETABLES

- BOTTLE GOURD 0.2
- BITTER GOURD 0.2
- CAULIFLOWER 0.2
- CUCUMBER –
- SPINACH 0.4
- TOMATO 0.2

FAT CONTENT (g /100 g)

Roots and Tubers

- Carrots 0.2
- Potato 0.2
- Turnip 0.2

Fruits

- Apple 0.3
- Apricot 0.4
- Banana 0.4
- Guava, whole 0.4
- Mango, ripe 0.3
- Orange, sweet 0.2

FAT CONTENT (g /100 g)

NUTS AND DRY FRUITS

- ALMOND 55.1
- WALNUT 63.6
- PISTACHIO 54.3
- PEANUT, ROASTED 42.9

DAIRY PRODUCTS

- BUTTER MILK (LASSI) 1.2
- CURD 3.4
- MILK, BUFFALO 7.8
- MILK, COW 3.8

FAT CONTENT (g /100 g)

MEAT

- BEEF 14.8
- CHICKEN MEAT 8.9
- GOAT MEAT 11.2

FISH

- FISH, SHANGHARA 3.4
- FISH, SOAL 2.7

EGGS

- EGGS, HEN RAW 10.8
- EGGS, HEN, BOILED 11.8

FAT CONTENT (g /100 g)

FATS AND EDIBLE OILS

- BUTTER 80.8
- GHEE, BUFFALO 99.5
- SOYBEAN OIL 100.0

SUGAR AND SWEETS

- SUGAR, WHITE 0.0
- ‘GUR’ 0.0
- HONEY 0.0
- ‘JALEBI’ 9.8
- HALWA, ‘SUJI’ 13.3
- HALWA, ‘GAJAR’ 23.3

FST-202. L # 28. FAT SUBSTITUTES

- FATS - TARGET FOR REPLACEMENT ?
- FSs – CHARACTERISTICS & CLASSES
- PROTEIN BASED SUBSTITUTES
- CARBOHYDRATE BASED REPLACEMENTS
- SYNTHETIC COMPOUNDS

FAT SUBSTITUTES

FATS - TARGET FOR REPLACEMENT ?

- RELEASE OVER TWICE ENERGY THAN CARBOHYDRATES
- POTENTIAL RISK OF SEVERAL DISEASES

CONSUMERS DEMAND FOODS

- LOW IN FAT CONTENT
- CALORIE FREE FAT SUBSTITUTES

FAT SUBSTITUTES

FSs – CHARACTERISTICS & CLASSES

- INGREDIENTS CONTRIBUTE FEW OR ZERO CALORIES
- DO NOT ALTER FLAVOR, MOUTH-FEEL, VISCOSITY, OR OTHER SENSORY PROPERTIES
- MOST INGREDIENTS PROMOTED AS PARTIAL OR COMPLETE REPLACEMENTS FOR FAT IN FOODS

FAT REPLACERS CLASSIFIED INTO

- PROTEIN BASED SUBSTITUTES
- CARBOHYDRATE BASED REPLACEMENTS
- SYNTHETIC COMPOUNDS

CLASS	TYPE & EXAMPLE	FUNCTION
CARBOHYDRATE BASED	• Cellulose (Vivapur) • Dextrins, modified starches (Stellar) • Fruit-based fibre (WonderSlim) • Grain-based fibre (Betatrim) • Hydrocolloid gums • Maltodextrin (Maltrin) • Pectin (Grinsted)	Binder, body, bulk, flavor, moisture retention, mouth feel
PROTEIN BASED	• Microparticulate protein (Simplesse) • Modified whey protein concentrate (Dairy-Lo)	Mouth feel, water-binding, reduce syneresis
FAT BASED	• Altered triglycerides (Caprenin) • Sucrose polyesters (Olestra) • Esterified propoxylated glycerol (EPG)	Emulsion, mouth feel
COMBINATION	• Carbohydrate and protein (Mimix) • Carbohydrate and fat (Optamax)	Flavor, texture, mouth feel, water retention

PROTEIN BASED FAT SUBSTITUTES

SIMPLESSE

- INTRODUCED IN 1988 BY CP Kelco
- A MULTI-FUNCTIONAL DAIRY INGREDIENT MADE FROM WHEY PROTEIN CONCENTRATE USED AS A FAT SUBSTITUTE IN LOW-CALORIE FOODS
- CONTRIBUTES 1.3 K. Cal / g (1 g PROTEIN + 2 g WATER REPLACE 3 g FAT OR 4 K. Cal REPLACE 27 K. Cal)
- USED IN DAIRY PRODUCTS LIKE YOGHURT, CHEESE SPREAD, CREAM CHEESE, SOUR CREAM
- SALAD DRESSING, MAYONNAISE AND MARGARINE
- NOT SUITABLE FOR FRYING

CARBOHYDRATE BASED FSs

GUMS

- GUMS ARE HYDROPHILIC COLLOIDS, INCLUDE
  - XANTHAN GUM
  - GUAR GUM
  - LOCUST BEAN GUM
  - GUM ARABIC
  - CARRAGEENAN

CARBOHYDRATE BASED FSs

GUMS

- VIRTUALLY NON-CALORIC
- PROVIDE THICKENING EFFECT
- CAN PROMOTE CREAMY TEXTURE
- INCREASE VISCOSITY
- LEAD TO EMULSION STABILITY
- DO NOT SERVE AS DIRECT SUBSTITUTES FOR FATS OR OILS BUT ARE USED AS FORMULATION TOOLS
- USED IN RANGE OF 0.1 - 0.5 %
- USED TO PRODUCE LOW-CALORIE, FAT-FREE SALAD DRESSINGS
- REDUCE FAT CONTENT OF VARIETY OF FORMULATED FOODS

CARBOHYDRATE BASED FSs

POLYDEXTROSE

- A POLYMER OF DEXTROSE WITH SMALL AMOUNT OF SORBITOL AND CITRIC ACID
- CALORIC VALUE - 1 K. Cal / g
- USED AS PARTIAL SUBSTITUTE FOR FAT IN
  - CANDY, CANDY COATINGS, CHEWING GUM
  - FROZEN DAIRY PRODUCTS
  - DRY MIXES
  - NUTRITIONAL BARS
  - PUDDINGS
  - DRY CAKE
  - COOKIE MIXES

CARBOHYDRATE BASED FSs

MALTODEXTRINS

- NON-SWEET NUTRITIVE SACCHARIDE POLYMER
- CONSISTS OF d-GLUCOSE UNITS
- PRODUCED BY ACID OR ENZYME HYDROLYSIS OF
  - CORN STARCH
  - POTATO STARCH
  - WHEAT STARCH
  - TAPIOCA STARCH
- OFTEN USED AS CARRIERS FOR SWEETENERS

CARBOHYDRATE BASED FSs

MALTODEXTRINS

- USED TO BUILD
  - SOLUBLE SOLIDS
  - INHIBIT SUGAR CRYSTALLISATION
  - CONTROL FREEZE POINT
  - INCREASE VISCOSITY TO MIMIC FAT
- MALTRIN 040 (A MALTODEXTRIN) FROM HYDROLYSED CORN STARCH, PROVIDES 4 K. Cal /g
- USES: AS PARTIAL REPLACEMENT FOR FATS AND OILS OR CAN TOTALLY REPLACE FAT IN MARGARINE, FROZEN DESSERTS, SALAD DRESSINGS AND SNACKS.

OTHER CARBOHYDRATE BASED FSs

- INCLUDE N-Oil® IS A TAPIOCA DEXTRIN, PROVIDES 1.2 K. Cal /g
- PASELLI SA2 - POTATO STARCH BASED MALTODEXTRIN, PROVIDES 3.8 K. Cal /g
- STA-SLIM, PROLESTRA, NUTRIFAT, FINESSE AND COLESTRA
- FIND APPLICATIONS IN SEVERAL FOODS

SYNTHETIC COMPOUNDS

OLESTRA

- NON-ABSORBABLE SYNTHETIC FAT
- MIXTURE OF HEXA TO OCTA ESTERS OF SUCROSE WITH NATURALLY OCCURRING LONG CHAIN FATTY ACIDS
- MADE FROM SUGAR AND VEGETABLE OIL
  - STABLE DURING HEATING, EVEN DEEP FAT FRYING
  - PROVIDES TASTE, TEXTURE AND MOUTH-FEEL OF CONVENTIONAL FATS
  - NOT DIGESTED, NOR ABSORBED - HENCE ZERO CALORIES.

OTHER SYNTHETIC COMPOUNDS

- EPG (ESTERIFIED PROPOXYLATED GLYCEROL) - CAN BE SUBSTITUTED FOR FATS AND OILS IN FROZEN DESSERTS, SALAD DRESSINGS AND BAKERY PRODUCTS

- TATCA (TRIALKOXYTRICARBALLYATE) - USED TO PRODUCE ACCEPTABLE MARGARINE

- DDM (DIALKYL DIHEXADECYLMALONATE) - USEFUL FOR HIGH TEMPERATURE APPLICATIONS

- EPG & TATCA RESISTANT TO HYDROLYSIS BY DIGESTIVE ENZYMES, DDM MINIMALLY DIGESTED AND LESS THAN 0.1 % ABSORBED.

FST- 202: L # 29, 30, 31,32

DIET RELATED DISEASES

Nutrient and Dietary Deficiency Disorders **Symptoms** **Causes** **Prevention**	**1. Malnutrition** **2. Obesity** **3. Coronary Diseases** **4. Diabetes** **5. Lactose Intolerance** **6. Gluten Intolerance** **7. Dental Caries**

FST-202. L # 29. **Malnutrition**

- Nutrition
- Good / Healthy Nutrition
- Poor Nutrition
  - Under Nutrition
  - Over Nutrition
- Malnutrition – ill consequences in body of under / over nutrition

DIET AND MALNUTRITION

- FOOD IS CONSUMED FOR HEALTHY LIVING
  - *KNOWN TO CAUSE NUMEROUS DISEASES*
- AFFLUENT SOCIETIES → **OVER NOURISHMENT**
- POOR PEOPLE → **UNDER NOURISHMENT**
- **NON-OPTIMAL** QUANTITIES CONSUMPTION
  - *IMPLICATED IN NUMBER OF DISEASES*

DIET

- DIET IS THE MAJOR ENVIRONMENTAL INFLUENCE AFFECTING HUMAN HEALTH
- **NATURAL FOODS** - RICH IN SUBSTANCES BENEFICIAL FOR HEALTH
- SOME COMPONENTS HARMFUL
  - *INTRINSIC*
  - *EXTRANEOUS*

DIET AND DISEASE ?

MALNUTRITION

- CONSUMPTION OF NON-OPTIMAL QUANTITIES LEADS TO SPECIFIC HEALTH DISORDERS

MALNUTRITION

- OVER OR UNDER CONSUMPTION OF FOOD NUTRIENTS

OVER NUTRITION

- *COMMON IN WELL–TO–DO FAMILIES*
- *EAT IN EXCESS*
- *DO LITTLE PHYSICAL WORK*
- *ALSO INDIVIDUALS LESS KNOWLEDGEABLE IN RULES OF PROPER NUTRITION*

MALNUTRITION

- EXCESSIVE CONSUMPTION
- FATTY AND CARBOHYDRATE FOODS
  - *UNDUE ACCUMULATION OF FAT IN ADIPOSE TISSUES*
  - *IMPLICATED IN OBESITY*
- PROTEIN RICH FOODS
  - *STRAIN LIVER AND KIDNEYS*
  - *POSSIBLY REDUCE LIFE EXPECTANCY OF INDIVIDUAL*
- MINERAL ELEMENTS AND VITAMINS
  - *ADVERSE EFFECTS ON HEALTH*

MALNUTRITION

UNDER NUTRITION – MORE SERIOUS

- *UNIVERSAL AMONG POOR FAMILIES AND NATIONS*
- *RESULTS FROM CONSUMPTION OF POOR DIETS OVER PROLONGED PERIODS*
- *SINGLE MOST IMPORTANT PUBLIC HEALTH PROBLEM IN MANY DEVELOPING COUNTRIES*
- *ABOUT **30 %** CHILDREN IN WORLD UNDERWEIGHT*

MALNUTRITION

CARBOHYDRATE AND PROTEIN DEFICIENCY

- MOST PREVALENT FORM OF UNDER-NOURISHMENT
- PROTEIN DEFICIENCY - COMMON AMONG
  - *VERY POOR PEOPLE*
  - *DURING PERIODS OF FAMINE, DROUGHT, FLOODS, CIVIL WARS*
  - *RESPONSIBLE FOR KWASHIORKOR IN CHILDREN*
  - *ESTIMATED 200 MILLION CHILDREN SUFFER*

MALNUTRITION

UNDER NOURISHMENT MANIFESTATIONS

- DEFICIENCY OF VITAMINS AND MINERAL ELEMENTS LEADS TO ONSET OF DIFFERENT DISEASES
- THREE WIDESPREAD **MICRONUTRIENT DEFICIENCIES** GLOBALLY
  - *LACK OF IRON* — *ANAEMIA*
  - *VITAMIN A DEFICIENCY* — *NIGHT BLINDNESS*
  - *IODINE DEFICIENCY* — *GOITRE*
  - *Ca + VIT D DEFICIENCY* — *RICKETS, OSTEOMALCIA, OSTEOPOROSIS*
- INCREASE CHILD MORTALITY AND HAVE OTHER ADVERSE CONSEQUENCES:

MALNUTRITION

CONSEQUENCES OF UNDER NUTRITION

- REDUCED IMMUNITY TO INFECTIONS
- INADEQUATE DIETARY INTAKE RESULTS IN
  - *WEIGHT LOSS*
  - *POOR GROWTH*
  - *LOWERED IMMUNITY*
  - *MUCOSAL DAMAGE*

THIS LEADS TO ONSET OF DISEASE

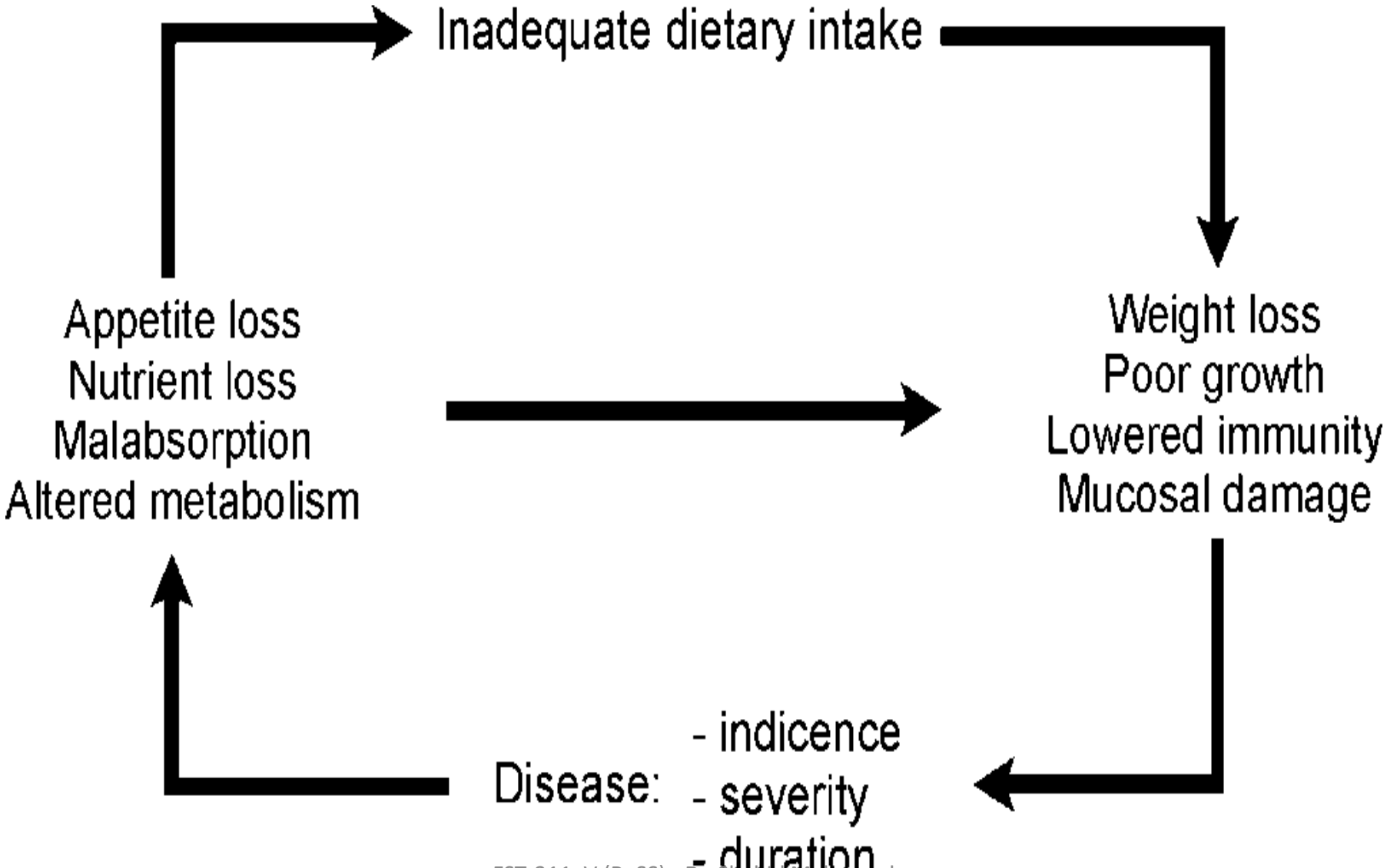
MALNUTRITION

- REDUCES APPETITE
- PROMOTES NUTRIENTS' LOSS BY
  - *MALABSORPTION OF NUTRIENTS*
  - *ALTERED METABOLISM*

MALNUTRITION - SITUATION IN PAKISTAN

- PROTEIN-CALORIE MALNUTRITION AFFECTS ALL AREAS
- MALNUTRITION PREVALENT IN:
  - BALUCHISTAN - ONLY **27 %** CHILDREN NORMALLY NOURISHED
  - NWFP NORMAL CHILDREN – **31 %**
  - SINDH – NORMAL CHILDREN – **36 %**
  - PUNJAB – NORMAL CHILDREN – **49 %**.

MALNUTRITION / INFECTION CYCLE



FST-202. L # 29. Malnutrition Assessment

- BMI
- BMI & Nutritional Status
- Human Body Composition
- Pakistan Health Profile-2019

WEIGHT STATUS ASSESSEMENT

MOST COMMON

Body Mass Index (BMI)

$$\mathbf{BMI(Kg/m2)} = \frac{\mathbf{Weight\ in\ Kg}}{\mathbf{Height\ in\ m2}}$$

1 Kg = 2.24 lb **(lb = pounds)**

1 inches = 2.54 cm

1m = 100 cm

BMI & NUTRITIONAL STATUS

Body Mass Index – BMI (Kg/m^2)		
Nutritional Status	**World**	**Asian**
Under weight	< 18.50	**< 17.50**
Normal weight	18.50 - 24.99	**17.50 - 22.99**
Over weight	25.00 - 29.99	**23.00 - 27.99**
Obese	> 30.00	**> 28.00**

(Adapted from: **WHO, 1995; WHO, 2000; WHO, 2004**)

BMI & NUTRITIONAL STATUS

BMI	Nutritional Status
< 18.5	Under Weight
18.5 - 24.9	Normal Weight
25.0 - 29.9	Pre-obesity
30.0 - 34.9	Obesity Class I
35.0 - 39.9	Obesity Class II
> 40	Obesity Class III

HUMAN BODY COMPOSITION (ADULTS)

Components (%)	Female	Male
Body Fat	**21 - 24**	14 - 17
Body Water	55 - 60	60 - 65
Body Muscle Mass	35 - 39	43 - 56
Body Bone Mass	12	14

(Body Composition Manual, BG-64, Germany)

PAKISTAN HEALTH PROFILE-2019

Total population (2016)	193,203,000
Gross national income per capita (PPP international $, 2013)	4,920
Life expectancy at birth m/f (years, 2016)	66/67
Probability of dying under five (per 1 000 live births, 2017)	75
Probability of dying between 15 and 60 years m/f (per 1 000 population, 2016)	178/139
Total expenditure on health per capita (Intl $, 2014)	129
Total expenditure on health as % of GDP (2014)	2.6
Latest data available from the Global Health Observatory https://www.who.int/countries/pak/en/ (WH0, 2019; 03-05-2019)	

FST-202. L # 30. OVERWEIGHT & OBESITY

- Definitions
- Obesity Assessment
- Body Fat (%) and Nutritional / Nutrition Status
- Overweight and Obesity

OVERWEIGHT AND OBESITY

"Overweight and obesity are defined as **abnormal** or **excessive** **fat** accumulation that presents a **risk** to health".

"Overweight and obesity are defined as abnormal or excessive fat accumulation that may impair health".

OVERWEIGHT AND OBESITY

- Overweight and obesity are defined as abnormal or excessive fat accumulation that presents a risk to health.
- Overweight and obesity are defined as abnormal or excessive fat accumulation that may impair health.
- A crude population measure of obesity is the body mass index (BMI), a person's weight (in kilograms) divided by the square of his or her height (in metres).
- A person with a BMI of 30 or more is generally considered obese. A person with a BMI equal to or more than 25 is considered overweight.
- Overweight and obesity are major risk factors for a number of chronic diseases, including diabetes, cardiovascular diseases and cancer.
- Once considered a problem only in high income countries, overweight and obesity are now dramatically on the rise in low- and middle-income countries, particularly in urban settings.

ASSESSMENT OF OBESITY FOR ASIAN ADULTS

Indicators		Units	Female	Male
Body Fat		%	≥ 31	≥ 25
BMI	Overweight	Kg/m^2	23.00 - 27.99	
	Obese		≥ 28	
Waist Circumference		cm	≥ 80	≥ 90
		inches	≥ 31.5	≥ 35.5

(WHO, 2012)

BODY FAT (%) AND NUTRITION STATUS

MOST SCIENTIFIC

Gender	Under Weight	Normal Weight	Obese
Adult Male	< 14	14 -17	≥ 25
Adult Female	< 21	21 -24	≥ 30

WEIGHT STATUS ASSESSEMENT

BODY FAT (%)

MOST RECENT AND ADVANCED SCIENTIFIC METHOD TO ESTABLISH WEIGHT STATUS

MEASURED

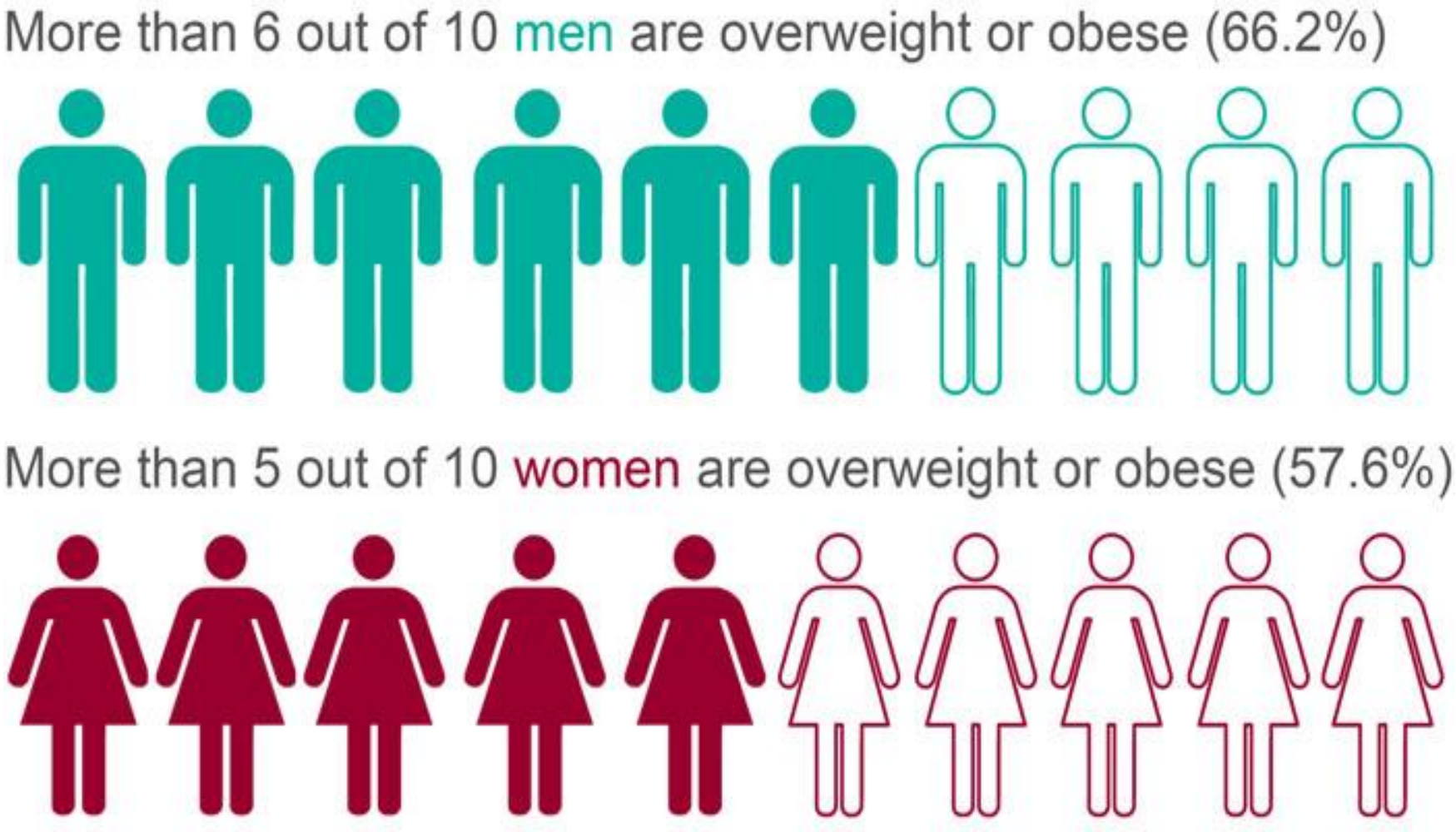
BY MANY METHODS BUT

THE MOST CONVENIWNT IS

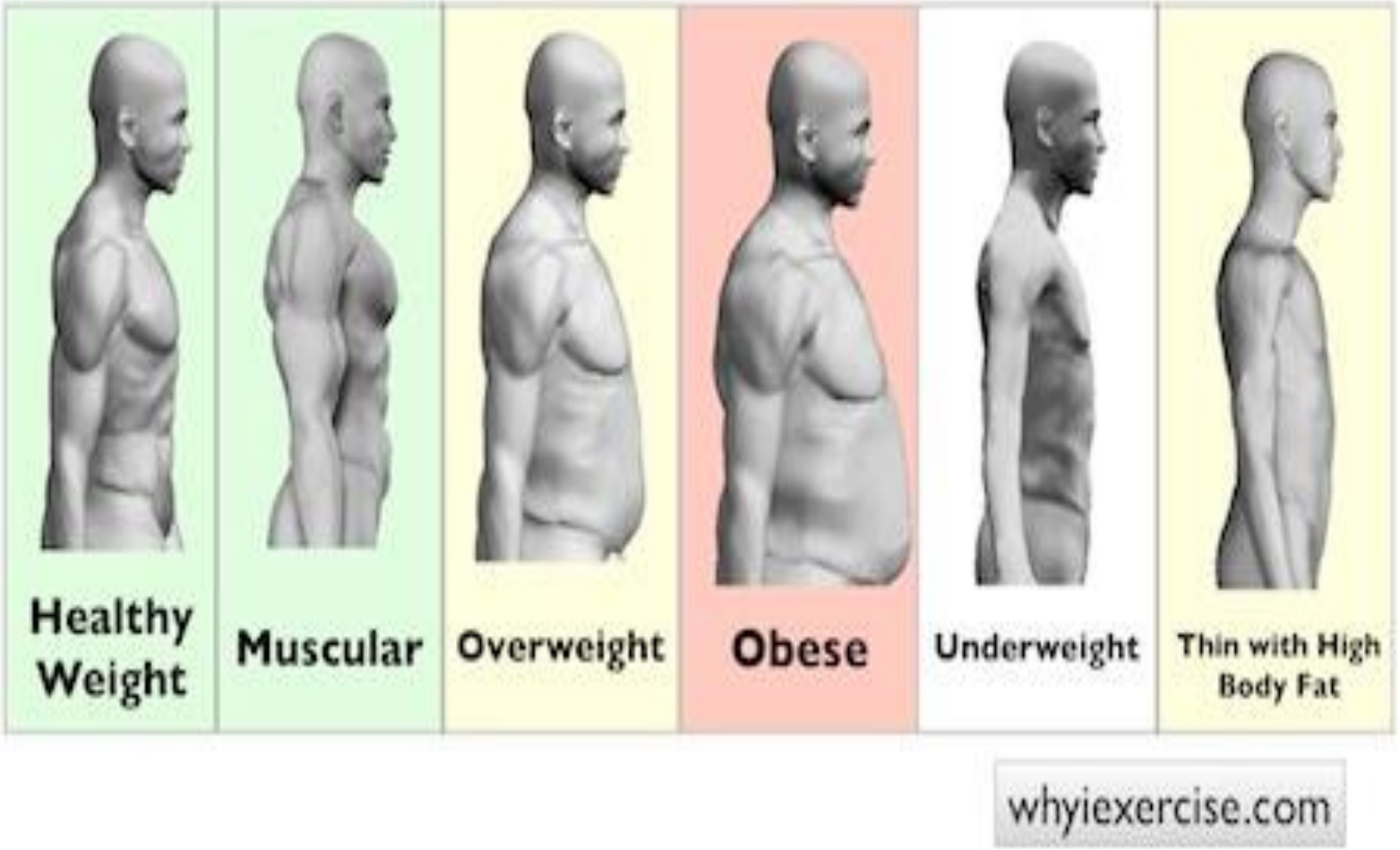
BIO-ELECTRICAL IMPEDANCE TECHNIQUE

OVERWEIGHT AND OBESITY

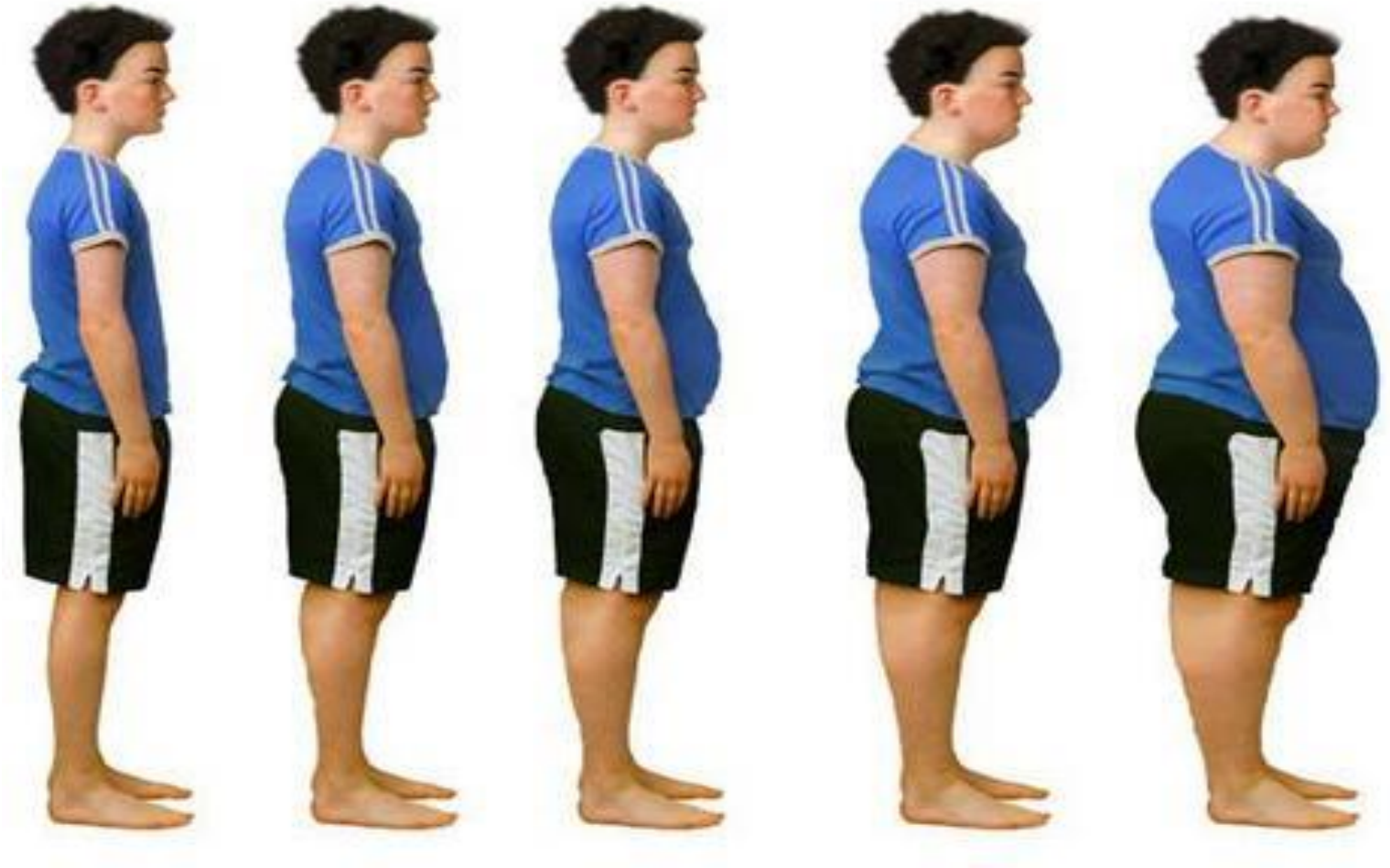
OVERWEIGHT AND OBESITY



OVERWEIGHT AND OBESITY



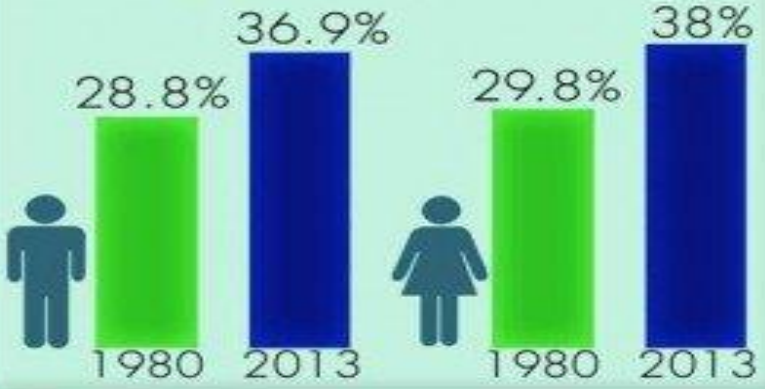
OVERWEIGHT AND OBESITY



OBESITY WORLDWIDE

2.1 BILLION
or nearly **30%**
of the world's population is obese or overweight

Rise in Overweight and Obesity



Countries With The Most Obese People

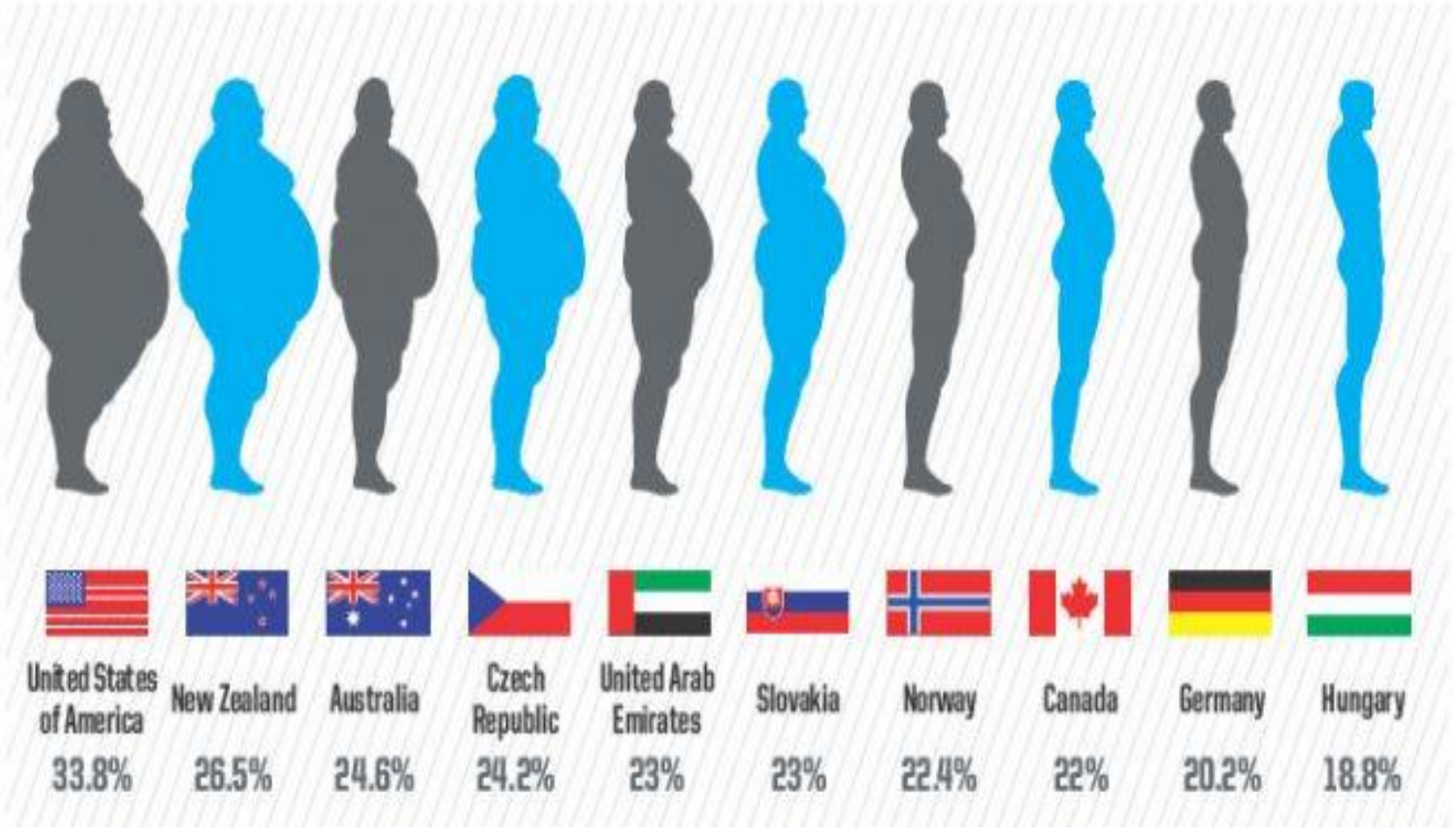
1. UNITED STATES
2. CHINA
3. INDIA
4. RUSSIA
5. BRAZIL
6. MEXICO
7. EGYPT
8. GERMANY
9. PAKISTAN
10. INDONESIA

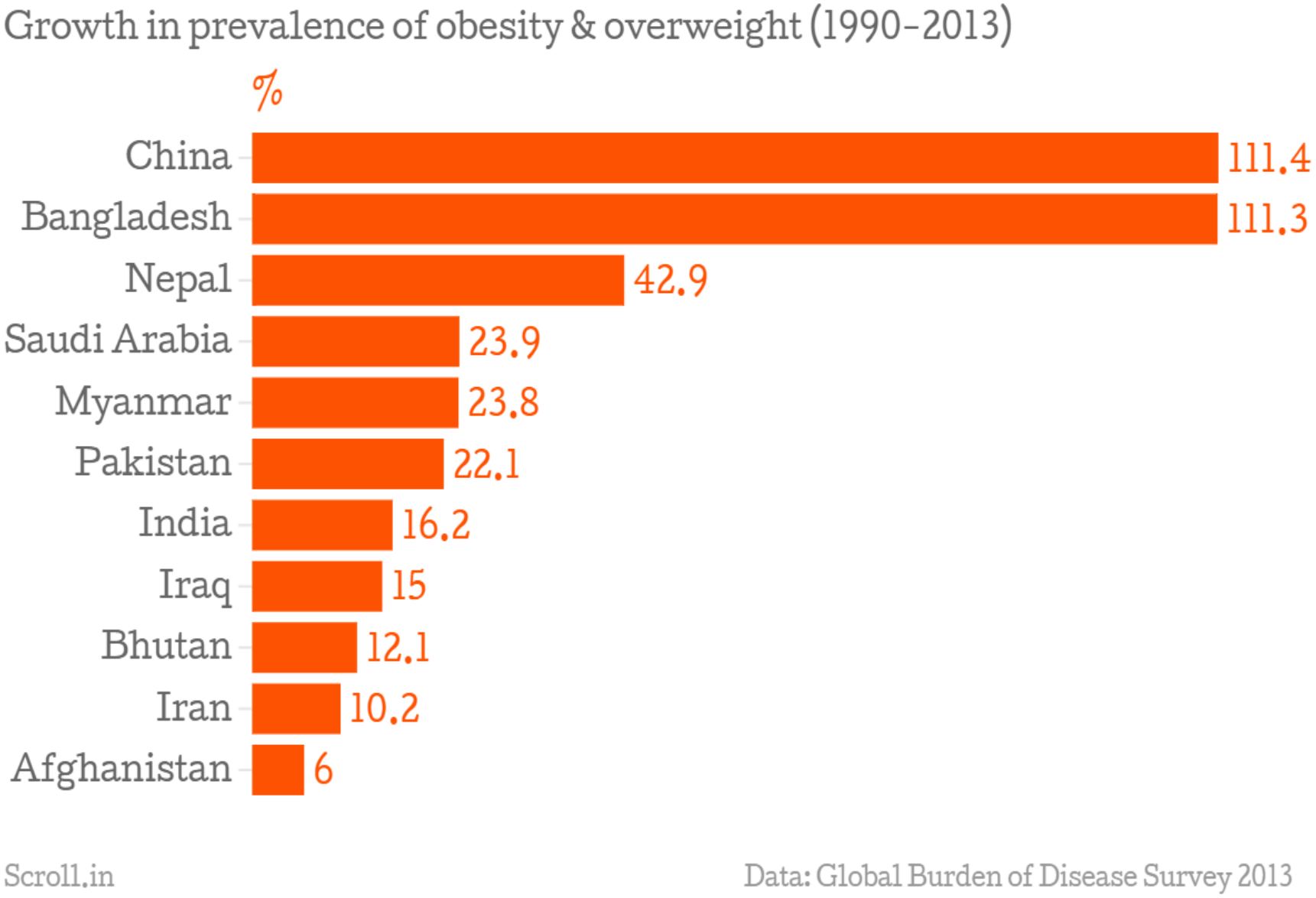
SOURCE: LANCET

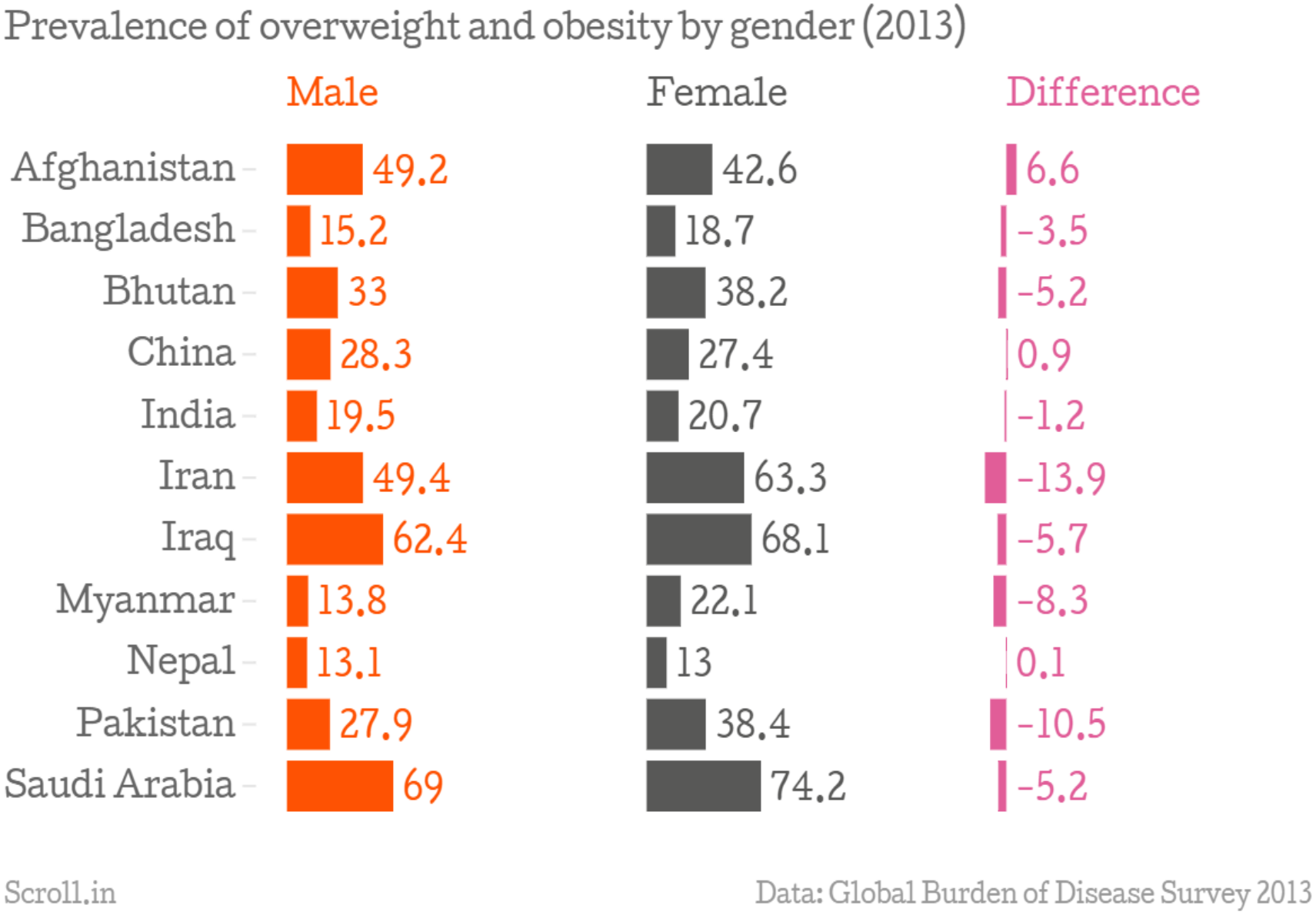
NIGHTLY NEWS with BRIAN WILLIAMS

THE 10 MOST OBESE COUNTRIES ON EARTH

According To The World Health Organization | % Obesity rate

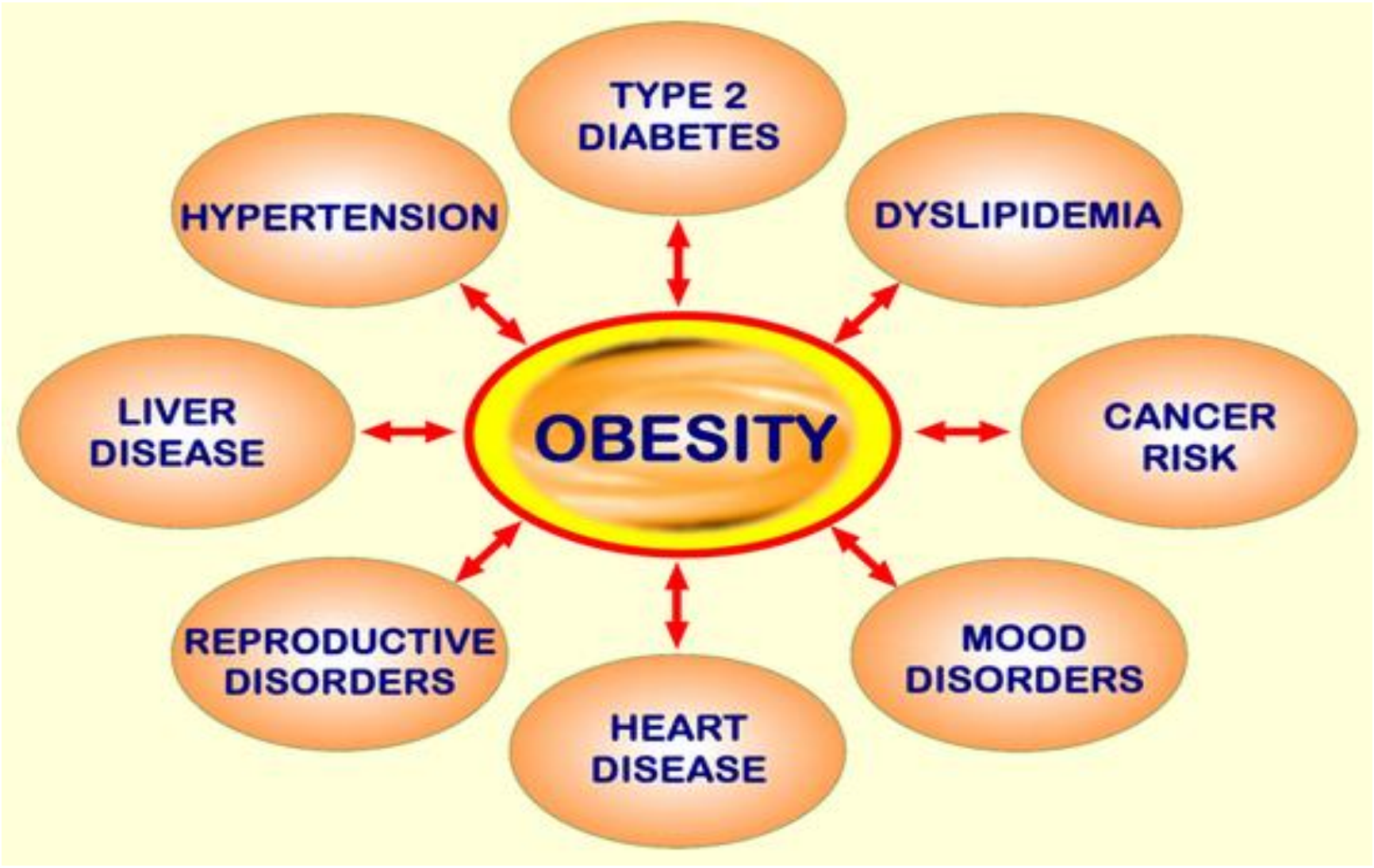



Growth in prevalence of obesity & overweight (1990–2013)
%
China
111.4
Bangladesh
111.3
Nepal
42.9
Saudi Arabia
23.9
Myanmar
23.8
Pakistan
22.1
India
16.2
Iraq
15
Bhutan
12.1
Iran
10.2
Afghanistan
6
Scroll.in
Data: Global Burden of Disease Survey 2013

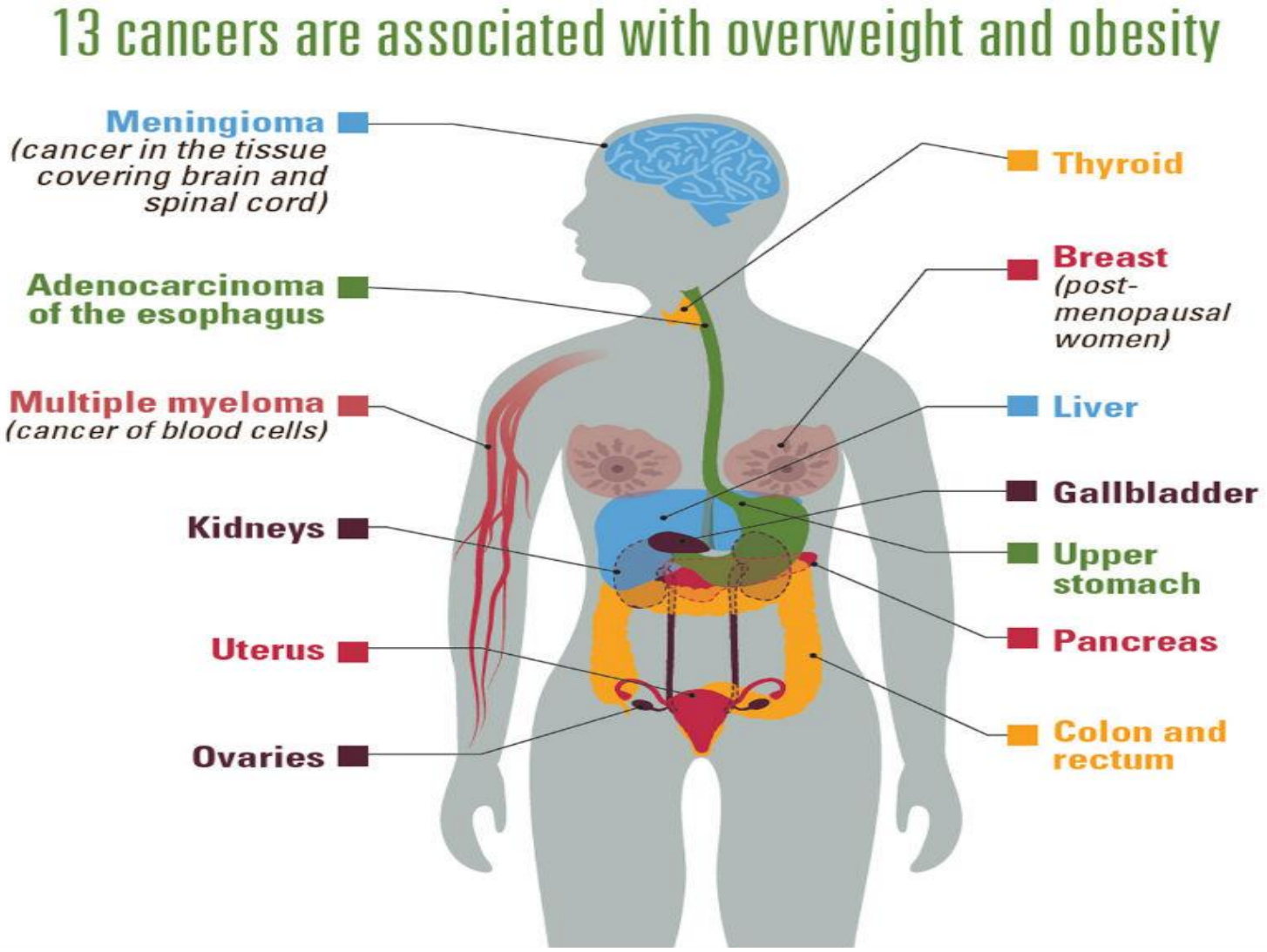

Prevalence of overweight and obesity by gender (2013)
Male
Female
Difference
Afghanistan
49.2
42.6
6.6
Bangladesh
15.2
18.7
-3.5
Bhutan
33
38.2
-5.2
China
28.3
27.4
0.9
India
19.5
20.7
-1.2
Iran
49.4
63.3
-13.9
Iraq
62.4
68.1
-5.7
Myanmar
13.8
22.1
-8.3
Nepal
13.1
13
0.1
Pakistan
27.9
38.4
-10.5
Saudi Arabia
69
74.2
-5.2
Scroll.in
Data: Global Burden of Disease Survey 2013


OVERWEIGHT POPULATIONS IN SOUTHEAST ASIA
21
44.2
26.5
30.2
32.2

OVERWEIGHT AND OBESITY



OVERWEIGHT AND OBESITY



OVERWEIGHT AND OBESITY

- OVERWEIGHT - MAJOR CONTRIBUTOR TO REDUCED LIFE EXPECTANCY
- STRONGLY LINKED WITH DEVELOPMENT OF
  - *CORONARY HEART DISEASE*
  - *DIABETES*
  - *GALLBLADDER DISEASE*
  - *HYPERTENSION*
  - *RESPIRATORY AILMENTS*
  - *CERTAIN FORMS OF CANCER*
  - *INCREASED RISK OF ARTHRITIS*
  - *LOW BACK PAIN*
  - *NUMEROUS OTHER PAINFUL CONDITIONS*

OVERWEIGHT AND OBESITY

- OVERWEIGHT SUBJECTIVE TERM, DEPENDS UPON BODY STRUCTURE
- HEIGHT AND WEIGHT CHARTS
  - *USUALLY GIVE IDEAL WEIGHTS OF INDIVIDUALS FOR GIVEN HEIGHT AND FRAME SIZE*
- OVERWEIGHT - IF WEIGHT 15-20 % ABOVE IDEAL WEIGHT INDICATED
- OBESITY - ABNORMAL ACCUMULATION OF ADIPOSE TISSUE THROUGHOUT BODY
- LINKED WITH AMOUNT AND DISTRIBUTION OF FAT IN BODY

OVERWEIGHT AND OBESITY

NEED FOR FAT IN BODY

- BODY REQUIRES MINIMAL AMOUNT OF FAT FOR
  - *INSULATION*
  - *CUSHIONING BETWEEN PARTS OF BODY AND VITAL ORGANS*
- MEN'S BODY SHOULD CONTAIN
  - *14 - 17 % TOTAL BODY FAT*
  - *NOT BELOW 3 - 4 %*
- MAN CONSIDERED OBESE IF TOTAL BODY FAT EXCEEDS 25 % BODY MASS

OVERWEIGHT AND OBESITY

- WOMEN SHOULD HAVE WITHIN 21 - 24 % FAT
- IF EXCEEDS 30 %, THEN WOMAN OBESE
- IN FEMALES BODY FAT NOT FALL BELOW 8 %
- RESULT
  - *AMENORRHEA DISRUPTION OF NORMAL MENSTRUAL CYCLE*
- TOO MUCH OR TOO LITTLE FAT BOTH POTENTIALLY HARMFUL

OVERWEIGHT AND OBESITY

- METHODS FOR DETERMINING AMOUNT OF
  - *PINCH TEST*
  - *HYDROSTATIC WEIGHING TECHNIQUE*
  - *SOFT TISSUE ROENTGENOGRAM*
  - *BIO ELECTRICAL IMPEDANCE TECHNIQUE*
- PINCH TEST USEFUL AND SIMPLE
  - *PINCHING FOLD OF SKIN (NOT MUSCLE) JUST BEHIND TRICEPS WITH THUMB AND INDEX FINGER*
  - *IF DISTANCE OR SIZE OF PINCH THICKER THAN 1 INCH, PERSON GENERALLY CONSIDERED OVER FAT*

OVERWEIGHT AND OBESITY: CAUSES

- INHERITED TRAIT
- PRESENCE OF EXCESSIVE NUMBER OF FAT CELLS IN BODY
  - *AVERAGE WEIGHT ADULT HAS ABOUT 25-30 BILLION FAT CELLS*
  - *MODERATELY OBESE ADULT ABOUT 60 -100 BILLION FAT CELLS*
  - *EXTREMELY OBESE 200 BILLION FAT CELLS*
  - *SIZE OF FAT CELLS INCREASES OR DECREASES DEPENDING UPON DIETARY HABITS*

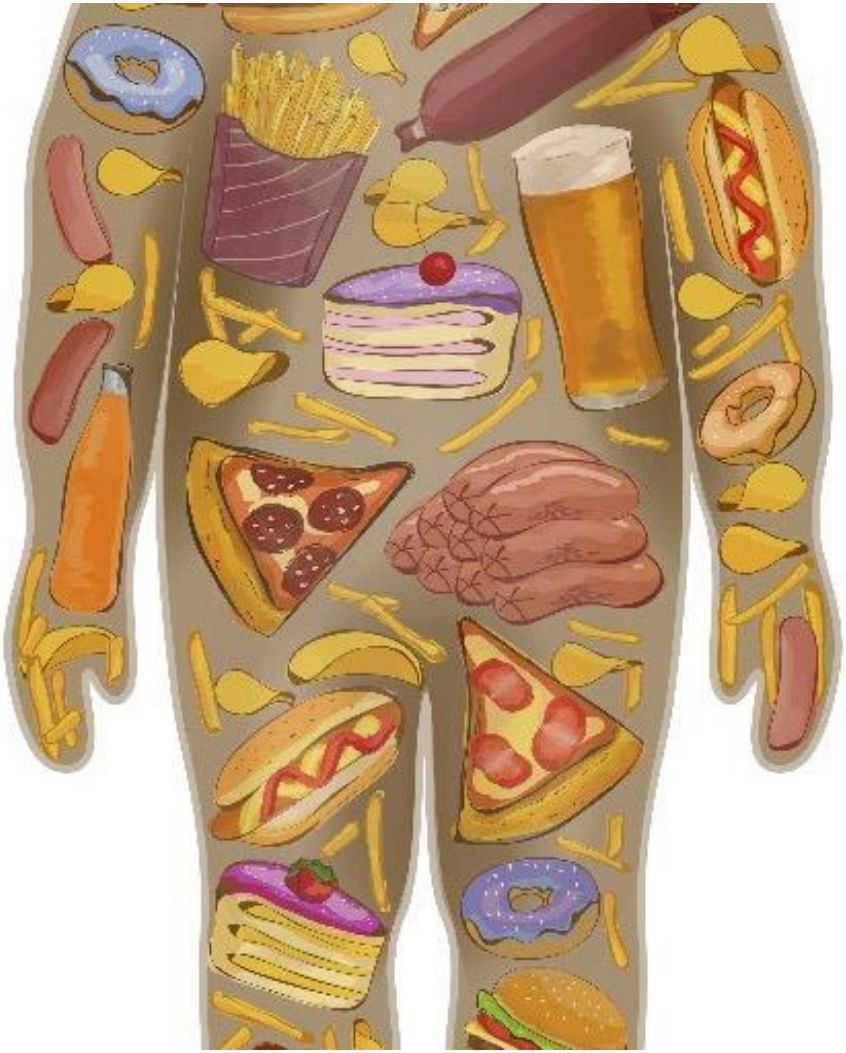
OVERWEIGHT AND OBESITY: CAUSES

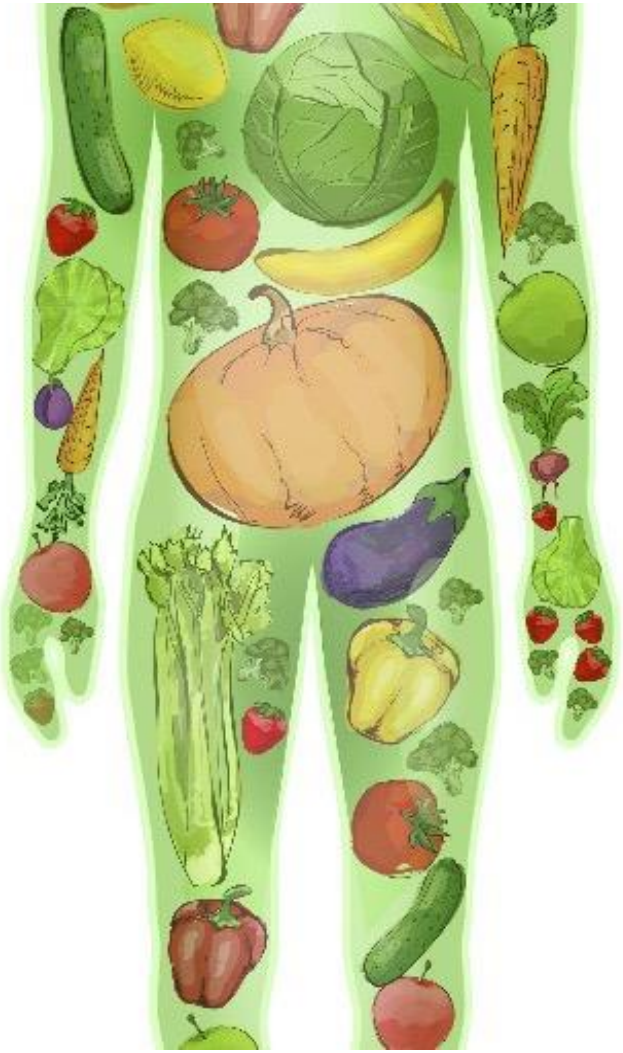
- UNDERACTIVE THYROID GLAND - PRODUCES HORMONE TO REGULATE METABOLISM
  - *IMPEDES ABILITY TO BURN UP CALORIES*
- MENOPAUSE LEADS TO INCREASED WAIST–TO–HIP RATIO AND 20 % GREATER BODY FAT MASS
- BMR DECREASES AFTER 25 YEARS AGE **- thyroxine**
  - *RESULTS IN ACCUMULATION OF FAT IN BODY.*
- LIFESTYLE
  - *LABOUR SAVING DEVICES*
  - *REDUCED PHYSICAL ACTIVITY*

OVERWEIGHT AND OBESITY: CAUSES

- **FOOD**
  - *MORE CONCENTRATED, RESULT OF REFINING*
  - *HIGH LEVELS OF FATTY, HIGH CALORIE FOODS*
- RELATIONSHIP BETWEEN ACTIVITY LEVEL AND CALORIE INTAKE IMPORTANT
- SEDENTARY PERSON CAN EASILY CONSUME FOOD CONTAINING **3,000 K. Cal** OR MORE IN A DAY
  - *EQUIVALENT TO ABOUT **400 g** BODY FAT*
  - *EQUIVALENT TO WALKING AT 4.5 Km /H FOR ABOUT 80 MINUTES*
- HENCE, EASIER TO GAIN WEIGHT THAN LOSE IT.

PREVENTION IS BETTER THAN CURE





FST-202. L # 31. DENTAL CARIES AND NUTRITION

- TEETH
- DENTAL CARIES DEVELOPMENT
- DENTAL CARIES PREVENTION
- Overweight and Obesity

DENTAL CARIES AND NUTRITION

DENTAL CARIES

TEETH

- THE HARDER STRUCTURES – DENTINE (the main supporting structure of the tooth and is the second hardest tissue in the body after enamel. It is 70% mineral and acellular, as hydroxyapatite)
- DO NOT ALLOW ACCUMULATION AND GROWTH OF MICROORGANISMS
- BACTERIA IDENTIFIED ON AND AROUND TEETH
- OVER **300 SPECIES**

DENTAL CARIES DEVELOPMENT

- FOOD RESIDUES REMAIN
  - ON TEETH / IN BETWEEN TEETH
- ALLOW ACCUMULATION OF MICROORGANISMS AND THEIR PRODUCTS
- DEPOSITS CALLED **DENTAL PLAQUES**
- INVOLVED IN FORMATION OF DENTAL CARIES, OR TOOTH DECAY

DENTAL CARIES DEVELOPMENT

BACTERIA, ESPECIALLY ***Streptococcus mutans*** (GRAM POSITIVE) AND SOME OTHERS, UTILISE SUGARS FROM:

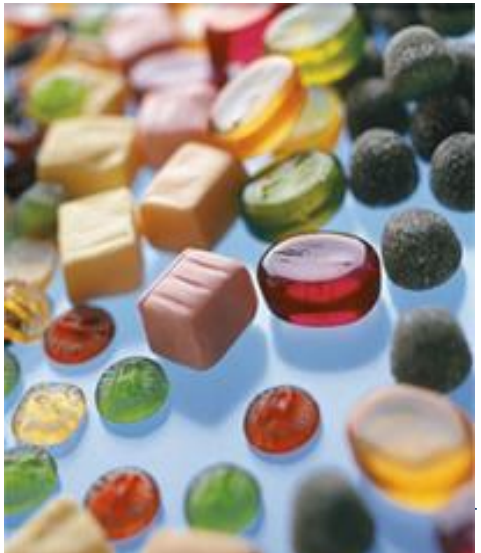
- *CANDIES*
- *HONEY*
- *APPLES*
- *MILK*
- *RAISINS*
- *BREAD*
- *OTHER FOODS*

DENTAL CARIES DEVELOPMENT

- BACTERIA CONVERT **SUGARS** INTO **LACTIC ACID**
- **LACTIC ACID**
  - *ATTACKS TOOTH ENAMEL*
  - *DISSOLVES CALCIUM FROM TOOTH SURFACE*
  - *FORMS CAVITY RESULTING IN DENTAL CARIES*

DENTAL CARIES DEVELOPMENT

- BACTERIA PENETRATE INTO INTERIOR OF TOOTH IF INITIAL PENETRATION OF ENAMEL BY CARIES REMAINS UNTREATED
- ONSET OF DENTAL CARIES IN THE PRESENCE OF
  - *FERMENTABLE CARBOHYDRATES IN MOUTH*
  - *TIME FOR GROWTH OF BACTERIA*



DENTAL CARIES PREVENTION

- ANY FOOD FORMING ACID IN MOUTH CARIOGENIC
- TABLE SUGAR HIGHLY CORRELATED WITH PRESENT LEVEL OF DENTAL CARIES
- PREVENTION
  - *MINIMAL INGESTION OF SUCROSE, ESPECIALLY IN BETWEEN MEALS*
  - *AVOID CONSUMPTION OF REFINED SUGAR*
  - *USE 'GUR' OR 'SHAKKAR'*

DENTAL CARIES PREVENTION

- FOLLOW ORAL HYGIENE
  - *CLEAN TEETH REGULARLY*
  - *CLEAN TEETH BEFORE GOING TO BED*
  - *RINSE MOUTH AFTER EATING FOOD, SWEETS*
- MAINTAIN EFFECTIVE ORAL HYGIENE
  - *TOOTHPASTES*
  - *TOOTH POWDER, 'MANJAN'*
  - *TRADITIONAL CHEWING STICKS*
    - *'KEEKAR MASWAK'*
    - *WALNUT BARK*

FST-202. L # 32. LACTOSE INTOLERANCE

- LACTOSE INTOLERANCE ?
- SYMPTOMS
- PREVALANCE
- DIAGNOSIS

LACTOSE INTOLERANCE

LACTOSE INTOLERANCE

- SOME PEOPLE FACE DIFFICULTY IN DIGESTING OF MILK OR MILK PRODUCTS
- INABILITY TO HYDROLYSE LACTOSE
  - *INCAPABLE TO SYNTHESISE LACTASE AT ALL*
  - *SYNTHESISE INADEQUATELY*
- INGESTION OF MORE LACTOSE IN MILK AND DERIVATIVES THAN CAN DIGEST
  - *BACTERIA IN COLON CONVERT LACTOSE INTO*
    - ACID
    - CARBON DIOXIDE

LACTOSE INTOLERANCE

- TYPICAL SYMPTOMS APPEAR WITHIN **30** MINUTES
  - ***NAUSEA***
  - ***CRAMPS***
  - ***BLOATING***
  - ***DIARRHOEA***
- DEGREE OF LACTOSE INTOLERANCE
  - *VARIES FROM PERSON TO PERSON*

LACTOSE INTOLERANCE

- BABIES BORN WITH CAPABILITY OF LACTASE FORMATION & LOSE THIS CAPABILITY IN EARLY CHILDHOOD
- BODY PRODUCES LESS LACTASE AFTER INFANCY

PREVALENCE

- *75 % WORLD'S ADULT POPULATION MAY EXPERIENCE SOME OR ALL SYMPTOMS OF LACTOSE INTOLERANCE*

LACTOSE INTOLERANCE

- INFANTS BORN WITH LACTASE DEFICIENCY UNABLE TO DIGEST MILK
- FOR SUCH CHILDREN, LACTOSE FREE MILK AVAILABLE
- ADULTS ADVISED TO DETERMINE DEGREE OF TOLERANCE:
  - *CONSUME SMALL AMOUNTS OF MILK WITH OTHER FOODS*
- LACTOSE INTOLERANCE PATIENTS EASILY DIGEST YOGHURT AND AGED CHEESE

LACTOSE INTOLERANCE

DIAGNOSIS - LABORATORY TESTS

- *LACTOSE TOLERANCE TEST*
- *HYDROGEN BREATH TEST*
- *STOOL ACIDITY TEST*

FST-202. L # 33. OSTEOPOROSIS AND NUTRITION

- OSTEOPOROSIS?
- CONTRIBUTORS TO DEVELOPMENT
- PREVENTION

Normal bone

Bone with Osteoporosis

OSTEOPOROSIS

- CONDITION IN WHICH AMOUNT OF BONE TISSUE VERY LOW
- BONES EASILY FRACTURE IN RESPONSE TO MINIMAL FORCE
- AFTER 40 YEARS, MEN AND WOMEN LOSE BONE MASS
- BONES BECOME LIGHTER AND THINNER
- FRACTURES OCCUR EASILY
- HEAL SLOWLY BECAUSE BODY NOT ABLE TO FORM NEW BONE EASILY

OSTEOPOROSIS

- CONTRIBUTORS TO DEVELOPMENT
  - *INADEQUATE CALCIUM AND VITAMIN D IN DIET*
  - *INSUFFICIENT EXERCISE*
  - *REDUCED OESTROGEN LEVELS IN WOMEN*
  - *COMMON AMONG POST–MENOPAUSAL WOMEN*

OSTEOPOROSIS

PREVENTION

- *CONSUMPTION OF MILK AND MILK PRODUCTS - PREVENT CALCIUM DEFICIENCY*
- *PROPER NUTRITION – BALANCED DIET*
- *ADEQUATE EXERCISE*
- *CALCIUM AND VITAMIN D SUPPLEMENTATION*
- *NON-SMOKING*

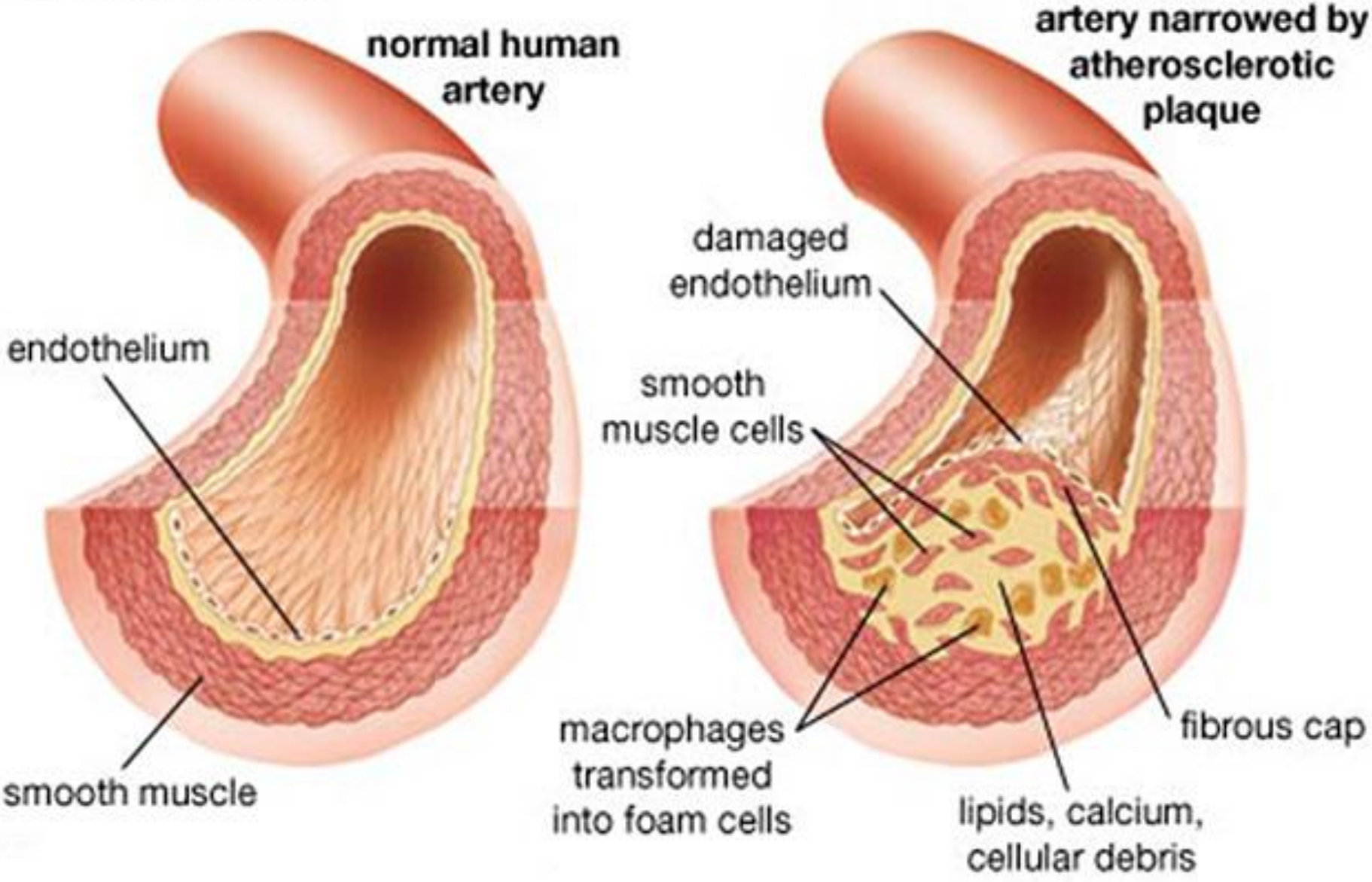
FST-202. L # 34

ATHEROSCLEROSIS, CORONARY HEART DISEASES AND NUTRITION

ATHEROSCLEROSIS, CORONARY HEART DISEASES AND NUTRITION

- PLAQUE - COMBINATION OF:
  - ***CHOLESTEROL***
  - ***CALCIUM***
  - ***OTHER MINERALS***
- MAJOR CAUSE OF ATHEROSCLEROSIS (HARDENING OF ARTERIES)
- ACTUAL AMOUNT OF CIRCULATING CHOLESTEROL NOT IMPORTANT AS RATIO OF CHOLESTEROL TO LIPOPROTEINS.

Atherosclerosis

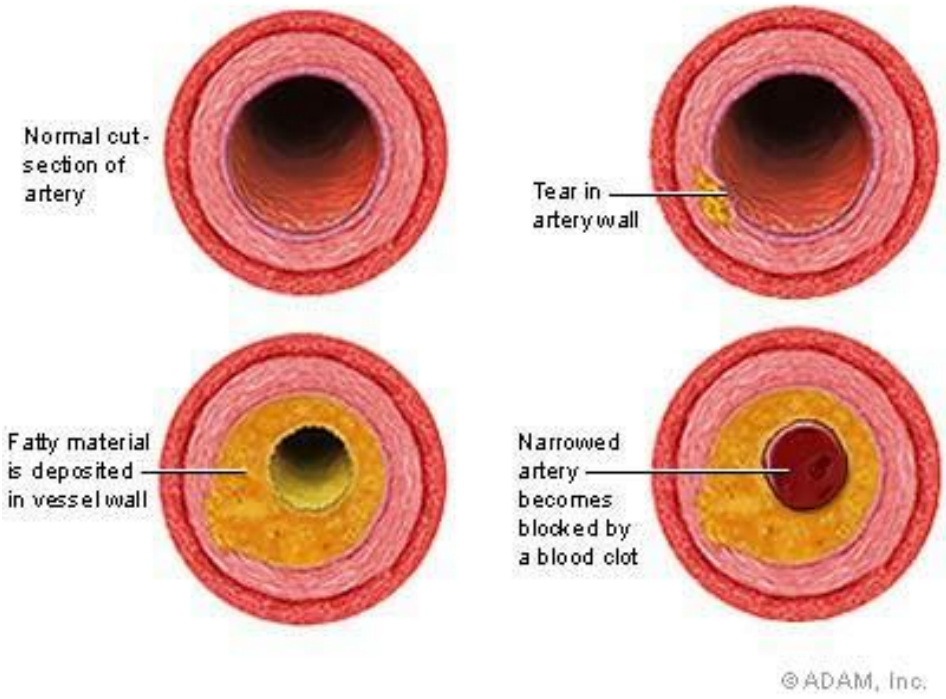


ATHEROSCLEROSIS, CORONARY HEART DISEASES AND NUTRITION

- LIPOPROTEINS
  - *HIGH DENSITY LIPOPROTEINS*
  - *LOW DENSITY LIPOPROTEINS*
- FACILITATE TRANSPORT OF CHOLESTEROL IN BLOOD
- HDLS TRANSPORT MORE CHOLESTEROL THAN LDLS
- HDLS CARRY CIRCULATING CHOLESTEROL TO LIVER FOR:
  - *METABOLISM*
  - *ELIMINATION FROM BODY*
- LDLS TRANSPORT CHOLESTEROL TO BODY'S CELLS

ATHEROSCLEROSIS, CORONARY HEART DISEASES AND NUTRITION

- PEOPLE WITH HIGH RATIO OF HDLS APPEAR AT LOWER RISK FOR DEVELOPMENT OF CHOLESTEROL
- LESS CLOGGED ARTERIES
- REGULAR VIGOROUS EXERCISE HELPS INCREASE HDLS



ATHEROSCLEROSIS, CORONARY HEART DISEASES AND NUTRITION

- SATURATED FATS AND CHOLESTEROL LINKED TO GROWING RISK FOR CORONARY ARTERY DISEASE
- DIETS HIGH IN SATURATED FATS LEAD TO:
  - *INCREASED TRIGLYCERIDE PRODUCTION*
  - *INCREASED CHOLESTEROL FORMATION*
  - *INTENSIFYING RISK OF CARDIO-VASCULAR PROBLEMs*

ATHEROSCLEROSIS, CORONARY HEART DISEASES AND NUTRITION

- SEDENTARY ADULTS NEED LARGE SCALE REDUCTION IN AMOUNT AND RELATIVE PROPORTION OF
  - *HIGH FAT FOODS*
  - *HIGH CHOLESTEROL FOODS*
    - ✓CHOLESTEROL NECESSARY FOR MANY BODILY FUNCTIONS
    - ✓HUMAN BODY CAN PRODUCE IT

ATHEROSCLEROSIS, CORONARY HEART DISEASES AND NUTRITION: PREVENTION AND CONTROL

- PRESENT DAY LIFESTYLE
  - ***SMOKING***
  - ***SEDENTARY LIFE***
  - ***STRESS***
  - ***AVAILABILITY OF REFINED AND ENERGY RICH FOODS***
- DIFFICULT FOR A PERSON SUFFERING FROM CVD TO FIND SUITABLE DIET
- DIETARY RECOMMENDATIONS ALMOST SAME AS FOR OBESE

ATHEROSCLEROSIS, CORONARY HEART DISEASES AND NUTRITION: PREVENTION AND CONTROL

- RECOMMEND-FIBRE–RICH FOODS (FRUITS, VEGETABLES, WHOLE CEREALS, WHOLE BEANS AND PULSES)
- FIBRE BINDS BILE (SYNTHESISED FROM CHOLESTEROL) IN STOMACH AND REMOVES IT WITH FAECES
- ABOUT **60 -100** g **PROTEIN** BE CONSUMED FROM SKIM MILK, LEAN MEAT, POULTRY OR FISH TO MEET REQUIREMENTS
- PREFERABLY USE OIL FOR COOKING – POLYUNSATURATED FATTY ACIDS HELP IN REDUCING BLOOD CHOLESTEROL

ATHEROSCLEROSIS, CORONARY HEART DISEASES AND NUTRITION: PREVENTION AND CONTROL

AVOID

- FOODS CONTAINING HIGH CHOLESTEROL
  - ***BRAIN***
  - ***LIVER***
  - ***KIDNEY***
  - ***EGG YOLK***
- SATURATED FATTY ACIDS - BUTTER, GHEE
- HIGHLY REFINED AND CONCENTRATED FOODS

FST-202. L # 35. CANCER AND NUTRITION

CANCER

- TERM "**CANCER**" REFERS TO NUMEROUS DIFFERENT DISEASES CHARACTERISED BY UNCONTROLLED GROWTH AND SPREAD OF ABNORMAL CELLS
- HEALTHY CELLS IN BODY PERFORM THEIR DAILY FUNCTIONS OF GROWING, REPLICATING, AND REPAIRING BODY ORGANS
- WHEN NORMAL CELL FUNCTIONS INTERRUPTED BY SOME FACTOR, **UNCONTROLLED GROWTH** AND ABNORMAL CELLULAR DEVELOPMENT OR NEOPLASMS BEGIN TO OCCUR
- THIS NEOPLASMIC MASS OFTEN FORMS A CLUMPING OF CELLS KNOWN AS A TUMOUR
- MOST TUMOURS BENIGN (NONCANCEROUS), GENERALLY HARMLESS, WHILE SOME CAN BE MALIGNANT (VERY DANGEROUS OR HARMFUL LIKELY TO CAUSE DEATH).

CANCER

- ONE THEORY PROPOSES THAT CANCER MAY RESULT FROM SOME SPONTANEOUS ERROR THAT OCCURS DURING CELL REPRODUCTION
- A SECOND EXPLANATION SUGGESTS THAT CANCER MAY BE THE RESULT OF SOME FORM OF EXTERNAL AGENT OR AGENTS THAT ENTER A NORMAL CELL AND CAUSE CANCEROUS PROCESS TO BEGIN
- NUMEROUS ENVIRONMENTAL CARCINOGENS SUCH AS RADIATION, CHEMICALS, HORMONAL DRUGS, IMMUNOSUPPRESSANT DRUGS AND OTHER TOXIC SUBSTANCES HAVE BEEN LISTED AS POSSIBLE DISEASE AGENTS.

CANCER

- EACH CANCER NAMED ACCORDING TO TYPE OF TISSUE FROM WHICH IT ARISES
- IT HAS A UNIQUE SET OF CHARACTERISTICS
- TYPICAL CLASSIFICATION OF THESE CANCERS: -
  - ***CARCINOMAS***
  - ***LYMPHOMAS***
  - ***LEUKAEMIA***

CANCER AND NUTRITION: CAUSES

- DIET AND TOBACCO ACCOUNT FOR MORE THAN **60 %** (ALMOST 30 % EACH), OF ESTIMATED CONTRIBUTING CAUSES OF DEATHS THROUGH CANCER
- OTHER FACTORS INCLUDE (IN DESCENDING ORDER OF NUMBER OF DEATHS):
  - ***INFECTION***
  - ***GENDER***
  - ***ETHYL ALCOHOL***
  - ***RADIATION***
  - ***INDUSTRIAL PRODUCTS***
  - ***ULTRAVIOLET LIGHT***
  - ***UNKNOWN***
  - ***OCCUPATION***
  - ***POLLUTION***
  - ***MEDICAL DRUGS***
  - ***FOOD ADDITIVES***
- SOME OF THESE FACTORS CAN BE CONTROLLED; HENCE CANCER MAY BE PREVENTED.

CANCER AND NUTRITION: CAUSES

- ENVIRONMENTAL CHEMICALS (PESTICIDES, HERBICIDES, PRESERVATIVES AND OTHERS) THAT EVENTUALLY END UP IN OUR FOOD SUPPLY ACCOUNT FOR ABOUT **40 - 50 % OF CANCERS**
- CERTAIN INTRINSIC CHEMICALS IN SOME FOODS MAY PROMOTE THE ERRATIC GROWTH OF CANCER CELLS
- MOREOVER, SOME FOOD PROCESSING TECHNIQUES (e.g. PROLONGED HEATING OF FATS AND OILS DURING FRYING) PROMOTE FORMATION OF CARCINOGENIC COMPOUNDS.

CANCER AND NUTRITION: PREVENTION And CONTROL

- LOW FAT DIET ENHANCES IMMUNE FUNCTIONING WHICH IS CRUCIAL FOR FIGHTING OFF ALL DISEASES, INCLUDING CANCER.
- DIET HIGH IN POLYUNSATURATED FAT DIMINISHES IMMUNE RESPONSIVENESS.
- LOW FAT, HIGH FIBRE PLANT BASED DIETS CAN SLOW OR REVERSE TUMOUR GROWTH AND BOLSTER THE BODY'S NATURAL RESISTANCE TO DISEASE.

CANCER AND NUTRITION: PREVENTION & CONTROL

- CERTAIN PLANT FOODS INHIBIT CANCER.
- PHYTOCHEMICALS IN BROCCOLI, CAULIFLOWER AND OTHER CRUCIFEROUS VEGETABLES HELP CANCER–FIGHTING ENZYMES PURGE CARCINOGENS IN CELLS.
- GARLIC STRENGTHENS THE IMMUNE SYSTEM.
- SOYFOODS CONTAIN GENISTEIN, A CHEMICAL THAT COUNTERACTS HORMONAL CANCERS AND SHRINKS TUMOURS.
- CAROTENOIDS IN ORANGE COLOURED FRUITS AND VEGETABLES AS WELL AS LEAFY GREENS SHIELD CELLS FROM SCREENING FREE–RADICALS THAT CAN CAUSE CANCER.
- A DIET HIGH IN FIBRE HELPS TO RETARD THE DEVELOPMENT OF SOME CANCERS BY INCREASING FAECAL BULK, THUS SPEEDING THE TRANSPORT OF CARCINOGENS OUT OF THE BODY.
- ANTIOXIDANT SUPPLEMENTS, INCLUDING VITAMINS A AND E HELP PERSON'S IMMUNE SYSTEMS REBOUND AFTER CHEMOTHERAPY.

CANCER AND NUTRITION: PREVENTION & CONTROL

NUTRITIONAL GUIDELINES TO PREVENT CANCER INCLUDE:

- REDUCE DIETARY FAT INTAKE, BOTH SATURATED AND UNSATURATED, TO PROVIDE ABOUT **30 %** OR LESS OF TOTAL CALORIES
- EAT MORE **HIGH FIBRE** FOODS – INCREASE CONSUMPTION OF FRUITS (APPLES, APRICOTS, CHERRIES, PEACHES, MELONS, STRAWBERRIES, MANGOES), VEGETABLES (BROCCOLI, CABBAGE, CAULIFLOWER, TURNIPS, RADISH, SPINACH) AND WHOLE GRAINS (WHOLE-WHEAT FLOUR CHAPATI, WHOLE PULSES)

CANCER AND NUTRITION: PREVENTION And CONTROL

- INCLUDE ONIONS AND GARLIC IN THE DIET.
- ALLOW FOODS RICH IN VITAMIN A AND C IN DAILY DIET
- AVOID ALCOHOLIC BEVERAGES.
- CONSUME SMOKED AND CHARCOAL BROILED FOODS (*'TIKKA', 'KEBAB'*) ONLY IN MODERATION.
- ABSTAIN FROM CONSUMPTION OF FOODS FRIED IN OILS / FATS THAT HAVE BEEN EXPOSED TO PROLONGED HEATING

FST-202. L #36. DIABETES AND NUTRITION

DIABETES

- DIABETES - DISEASE IN WHICH PANCREAS STOP PRODUCING INSULIN IN SUFFICIENT QUANTITIES TO ALLOW BODY TO STORE GLUCOSE (BLOOD SUGAR)
- INSULIN - HORMONE REQUIRED FOR METABOLISM OF CARBOHYDRATES
- TYPES OF DIABETES:
  - *TYPE 1 - JUVENILE OR INSULIN DEPENDENT*
  - *TYPE 2 - NON-INSULIN DEPENDENT*

DIABETESE DIAGNOSIS

- Fasting Plasma Glucose > 126 mg/dl
- Symptoms of Diabetes + Plasma Glucose >200 mg/dl
- 2 Hour Plasma Glucose > 200 mg/dl during OGTT
- $A_1C \geq 6.5\%$
- Indicative Symptoms
  - Polyuria
  - Polydipsia,
  - Polyphagia
  - Unexplained weight loss

DIABETES

TYPE 1 DIABETES – INSULIN DEPENDENT

- AN AUTOIMMUNE DISEASE - DESTROYS BODY'S ABILITY TO PRODUCE INSULIN
- SERIOUS FORM, DEVELOPS IN CHILDHOOD, YOUTH
- VICTIMS REMAIN DEPENDENT UPON INSULIN INJECTIONS OR ORAL MEDICATIONS FOR REST OF LIVES
- MUST TAKE DAILY INSULIN INJECTIONS TO LIVE
- ADVISED TO CAREFULLY WATCH THEIR DIETS
- THIS FORM ACCOUNTS FOR **5 – 10 %** OF CASES.

DIABETES

TYPE 2 DIABETES

- ADULT-ONSET
- ACCOUNTS FOR **90 – 95 %** CASES
- TENDS TO DEVELOP IN LATER LIFE - AFTER 40 YEARS OF AGE
- BODY
  - *UNABLE TO PRODUCE ENOUGH INSULIN TO MEET ITS NEEDS OR*
  - *CANNOT EFFECTIVELY MAKE USE OF IT*

DIABETES - TYPE 2 DIABETES

- WOMEN CAN DEVELOP A FORM OF TYPE 2 DIABETES, CALLED GESTATIONAL DIABETES, DURING PREGNANCY
- APPROXIMATELY **40 %** WOMEN WITH GESTATIONAL DIABETES AND OBESE BEFORE PREGNANCY DEVELOP TYPE 2 DIABETES WITHIN 4 YEARS
- PEOPLE WITH TYPE 2 DIABETES MAY BE ABLE TO CONTROL BLOOD SUGAR THROUGH DIET AND EXERCISE
- SOME MAY NEED TO TAKE ORAL DIABETES MEDICATION TO LOWER BLOOD GLUCOSE LEVEL

DIABETES - OCCURRENCE

- DIABETES TENDS TO RUN IN FAMILIES – HEREDITARY
- **RISK FACTORS**
  - *TENDENCY TOWARDS BEING OVERWEIGHT*
  - *COUPLED WITH INACTIVITY*
- ABOUT A THIRD PEOPLE WITH TYPE 2 DIABETES GO UNTREATED BECAUSE OF UNAWARENESS
- MANY DIAGNOSED WITH DIABETES LATE – AFTER DEVELOP SERIOUS COMPLICATIONS SUCH AS HEART ATTACK, KIDNEY DISEASE OR IMPAIRED EYESIGHT

DIABETES: RECOMMENDATIONS

- PERFORM BLOOD GLUCOSE SCREENING REGULARLY
- STARTING FROM AGE OF 45 YEARS
- ESPECIALLY IN FAMILIES THAT HAVE HISTORY OF DIABETES AND ARE OBESE.

DIABETES - SYMPTOMS

- DIABETICS EXHIBIT HYPERGLYCAEMIA - ELEVATED BLOOD SUGAR LEVELS AND HIGH GLUCOSE LEVELS IN URINE
- MOST COMMON SYMPTOMS:
  - ***FREQUENT URINATION***
  - ***EXCESSIVE THIRST***
  - ***EXCESSIVE HUNGER***
  - ***TENDENCY TO TIRE EASILY***
  - ***FREQUENT INFECTIONS***
  - ***SKIN ERUPTIONS***
  - ***SLOW HEALING OF WOUNDS***
  - ***SUDDEN CHANGES IN VISION***
  - ***TINGLING OR NUMBNESS IN THE HANDS OR FEET***
- IN FEMALES, A TENDENCY TOWARDS VAGINAL YEAST INFECTIONS COMMON.

DIABETES - SYMPTOMS

- NERVOUS TISSUES DO NOT HAVE ANY RESERVOIR OF GLUCOSE; HENCE CONSTANT SUPPLY ALWAYS NEEDED
- NERVOUS ACTIVITY DIRECTLY DEPENDENT UPON LEVEL OF GLUCOSE IN BLOOD
- IF GLUCOSE LEVEL IN BLOOD DROPS SUDDENLY, AS BY INJECTION OF EXCESSIVE AMOUNTS OF INSULIN, CHANGES IN NERVOUS ACTIVITY QUICKLY FOLLOW
- MENTAL CONFUSION FREQUENT SYMPTOM OF OVER DOSAGE IN DIABETIC PATIENTS.

DIABETES: PREVENTION AND CONTROL

RECOMMENDATIONS

- CONSUME FOODS RICH IN **DIETARY FIBRE**
  - *FRUITS, VEGETABLES, WHOLE CEREAL PRODUCTS, WHOLE BEANS*
- FOR 'CHAPATI' MAKING, SUPPLEMENT WHOLE WHEAT FLOUR WITH ABOUT **10-20 % GRAM** FLOUR (‘*BESAN*’) - BLEND ALSO USEFUL FOR CHILDREN
- MILK, MEAT, FISH, CHICKEN, EGGS AND BUTTER BE EATEN FOR NORMAL NUTRITION
- PROTEINS TO ACCOUNT FOR ABOUT 20 % CALORIES.

DIABETES: PREVENTION AND CONTROL

- CONSUME LOW CALORIE DIET IF OBESE
- AVOID - HIGHLY REFINED, CONCENTRATED AND FRIED FOODS
- REPLACE TABLE SUGAR WITH RAW SUGAR, '*SHAKKAR*' OR '*GUR*'
- EAT THREE TO FIVE MEALS IN A DAY
- INCREASE NUMBER OF MEALS PROVIDED TOTAL INTAKE NOT DISTURBED.

DIABETES: PREVENTION AND CONTROL

- PROTECT AGAINST DEVELOPMENT OF TYPE 2 DIABETES BY:
  - *MAINTAINING HEALTHY WEIGHT*
  - *EXERCISING REGULARLY*
- WEIGHT LOSS AND EXERCISE IMPORTANT FACTORS IN LOWERING BLOOD SUGAR AND IMPROVING EFFICIENCY OF CELLULAR USE OF INSULIN
- BOTH HELP PREVENT OVERWORK OF PANCREAS AND DEVELOPMENT OF DIABETES