Induction To Todays Topic

What Is Priority Of Any Human Being's Life?

Pick One First Most Important Thing

- Health
- Wealth
- Happiness
- Success
- Peace

Answer

Health Is Priority Of All Human Beings

What is Most Important Factor For Health?

Energy

Chemical Form Of Energy

ATP

Biochemical Energy

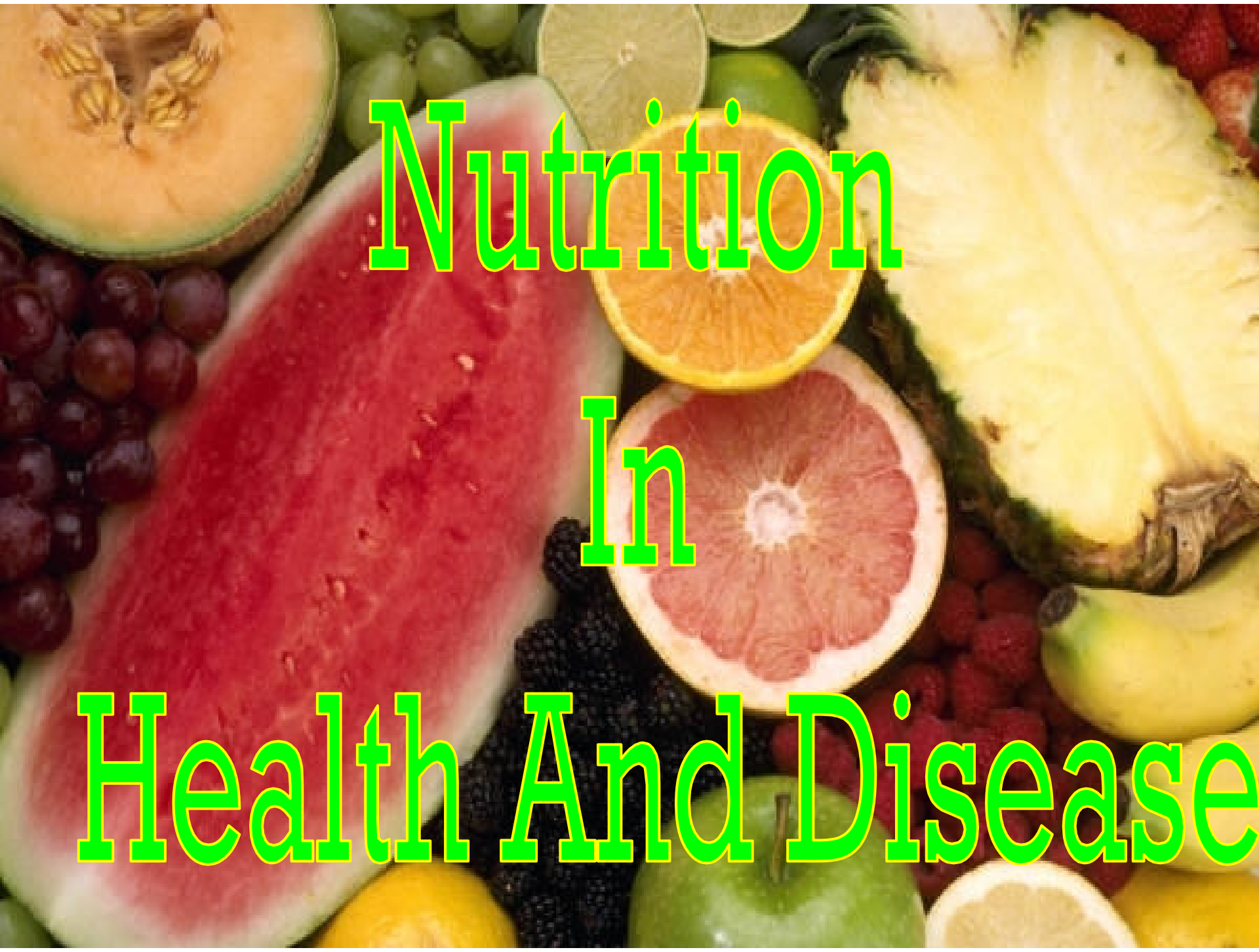
- Cells store and release energy using the chemical ATP
  - Adenosine triphosphate
- ATP is the "energy currency" of the cell
  - MANY cellular processes use ATP

- Cells release energy by breaking a phosphate bond

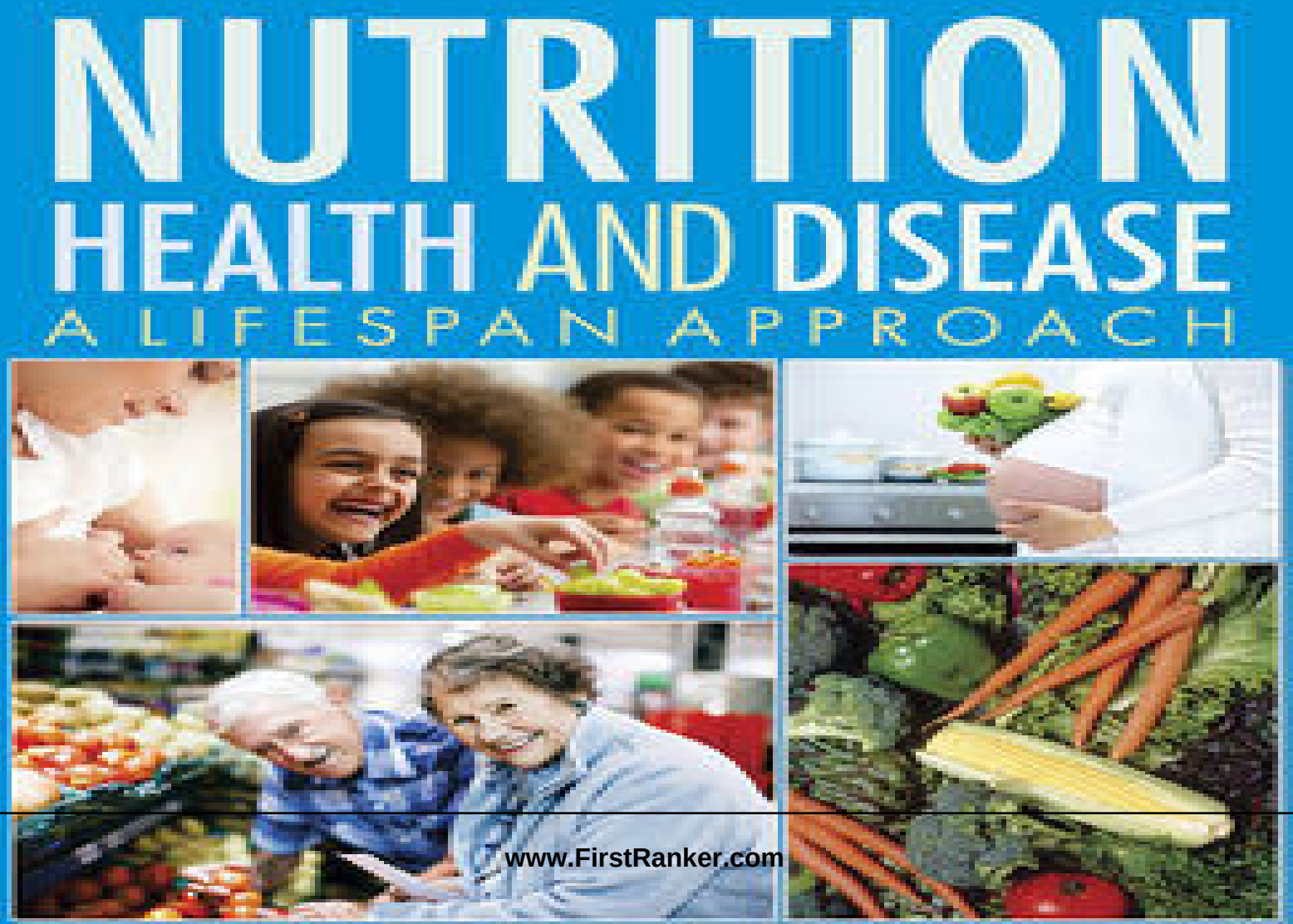
ATP Producing Factors

- **Air** (Oxygen)
- **Food/Diet** (Nutrients)

Any Guesses For Todays Topic?



Specific Learning Objectives



- What is Nutrition ?
- Importance of Studying Nutrition
- Nutritional Goals and Guidelines
- Food Nutrients and their roles
- Calorific Values/Energy content of Food nutrients
- Energy requirement by a body
- Basal Metabolic Rate (BMR)
- Respiratory Quotient(RQ)
- Specific Dynamic Action (SDA)

- Balanced Diet and its Importance
- RDA of various Nutrients
- Nutritional Disorders and Preventive Measures
  - PEM- Kwashiorkor and Marasmus
  - Obesity

INTRODUCTION

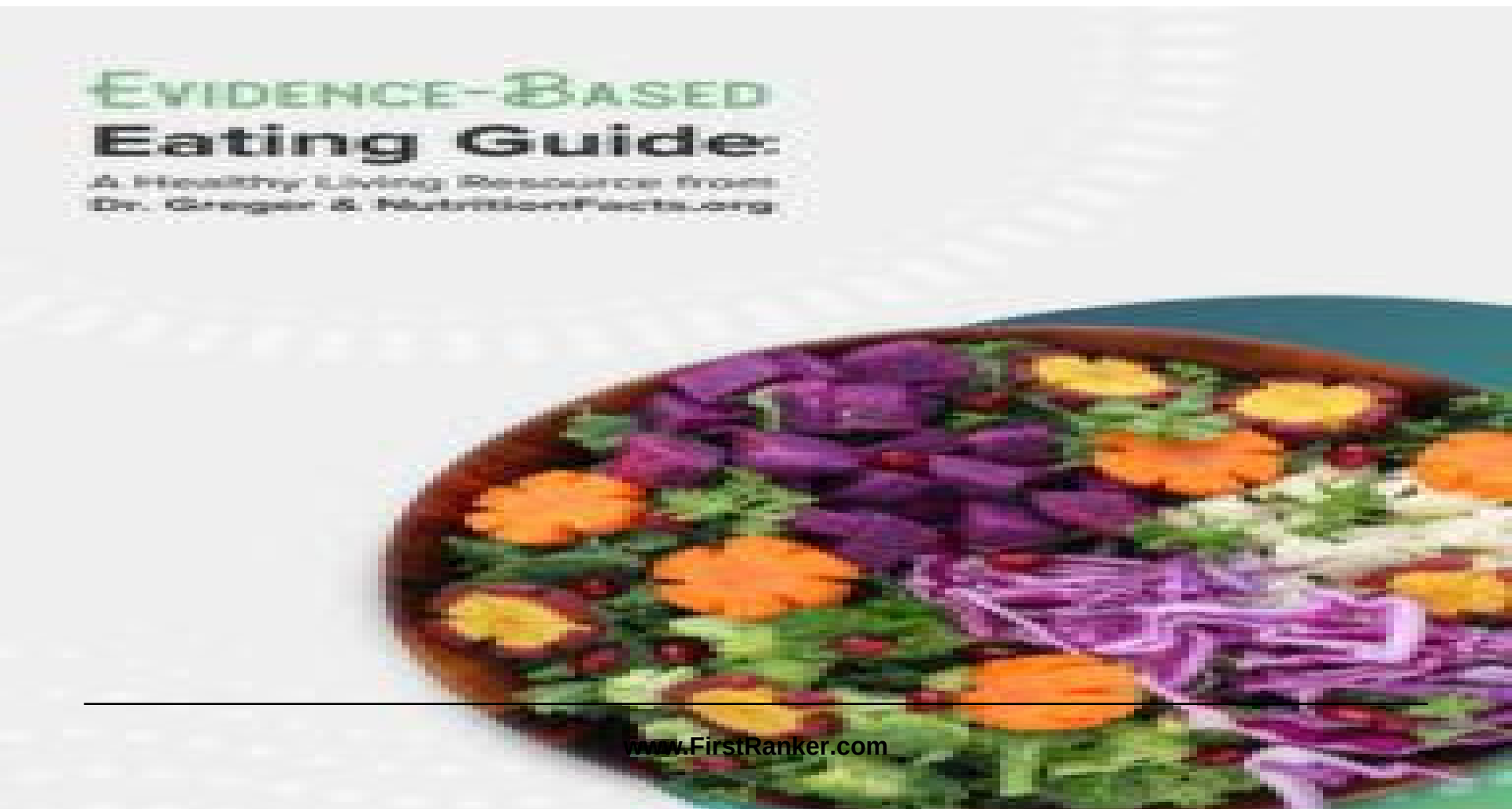
What is Nutrition?

Nutrition is a wide branch of Science which deals with:

- **Human food** its **role** in human body
- **Energy contents of food nutrients**
- **Energy requirement by Human Body**
- **Nutritional Disorders**

Importance Of Studying Nutrition

Evidenced Based Eating (EBE)



Know Do's and Don'ts Of Eating

So That One Can **Understand** Its Truth of Significance

Implement **Do's** and **Avoid** **Don'ts** Of Eating

Evaluate Its Significance in form of Strength and Health

Spread To Others - Family and Patients

STUDY OF NUTRITION

WILL

ANSWER FOLLOWING QUESTIONS

- **WHY TO EAT FOOD ?**
- **What and How to Eat Food?**
- **What are dietary nutrients and their role in human body?**
- **What are Macro and Micronutrients?**
- **What Quality and Quantity of dietary nutrients to be ingested?**
- **What happens if food is eaten in a balanced/imbalanced manner?**

❖**Knowledge Of Nutrition Explores**

❖**How thoughtfully and rightly one can choose particular food/ type of diet?**

❖**Planning of balanced diet in various phases and conditions for good health**

❖Nutritional Studies Involves

- ❖**Relation of Nutrients in health and disease**
- ❖**Understand and Prevent Nutritional disorders** due to **under and over nutrition**
- ❖**Nutrigenomics- Effect of Nutrients on Genes**

What Is Main Purpose of Eating Food ?

The Importance of Good Nutrition

- **Food/Diet** is a **prime requisite for human body health, survival and existence**

Importance of Food Nutrients

What we eat is directly/indirectly related to

Composition and Function of

Sub Cellular Organelles, Cells,Organs,System,

Body as Whole

- **Main purpose of Food is to:**

- **Supply basic building blocks, to build Macrobiomolecules, for structural composition of Cells,Organs,System and its function**

- **Provide Energy (Fuel)** for cellular activities

- **Enable to ingest and provide accessory growth factors**

- **Role Of Human Food**

- **Build Cell and Subcellular Structures**
- **Maintain** all **body functions**
- **Regulates Metabolism**
- **Therapeutic benefits of food**
  - **–Healing of diseases**
  - **–Prevention of diseases**

CELLULAR NUTRITION

List of Over 50 Food Based Nutrients needed for Good Cell Health

- Water
- Carbohydrates
- Fiber

Essential Amino Acids
- Arginine
- Histidine
- Leucine
- Isoleucine
- Lysine
- Methionine
- Phenylalanine
- Threonine
- Tryptophan
- Valine

Essential Fatty Acids
- Linoleic Acid
- Linolenic Acid
- Arachidonic Acid

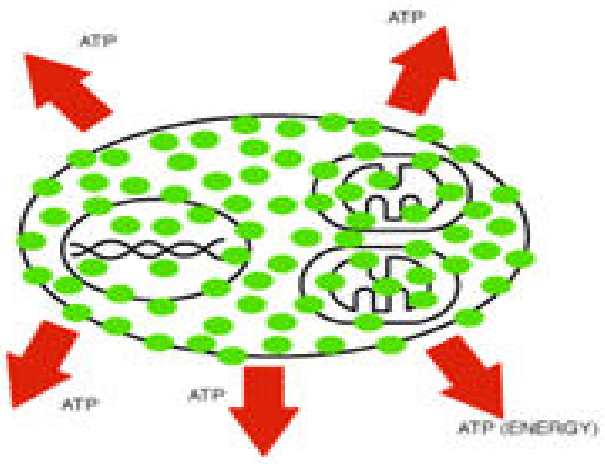
Minerals
- Sodium
- Magnesium
- Phosphorous
- Chlorine
- Potassium
- Calcium

Fat-Soluble Vitamins
- Vitamin A (retinol)
- Viramin D
- Vitamin E
- Vitamin K

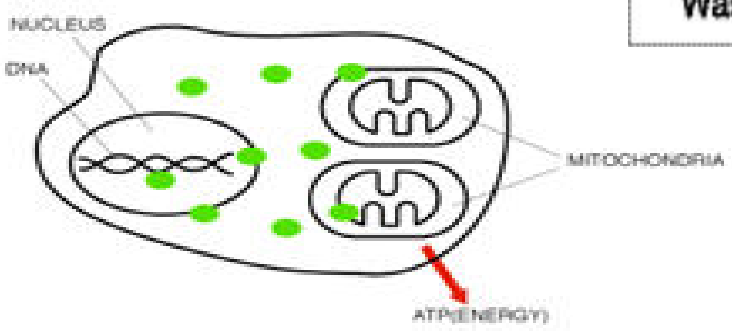
Trace Minerals
- Iron
- Copper
- Iodine
- Manganese
- Chromium
- Zinc
- Fluorine
- Selenium
- Molybdenum
- Tin
- Silicon
- Vanadium
- Cobalt
- Nickel
- Arsenic

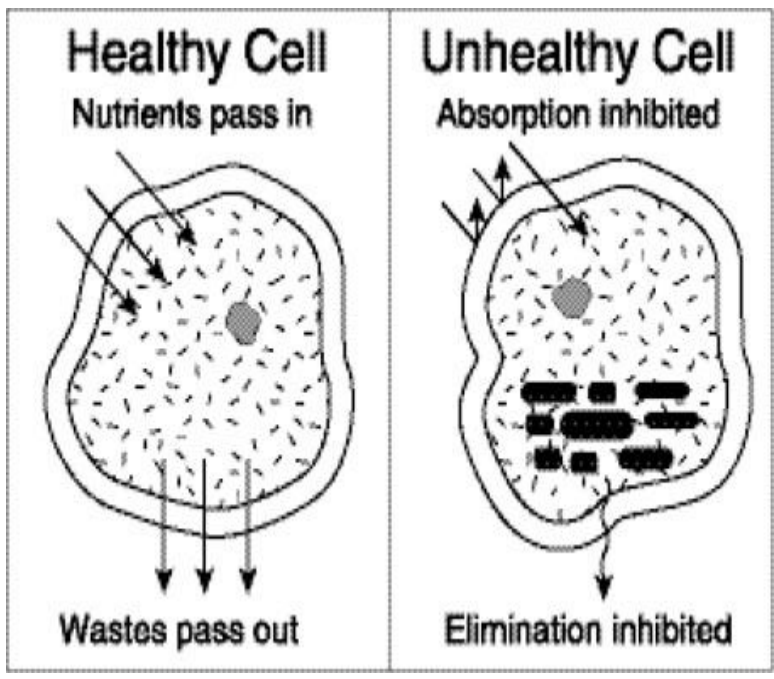
Water-Soluble Vitamins
- Vitamin B1 (thiamin)
- Vitamin B2 (riboflavin)
- Vitamin B3 (niacin)
- Vitamin B5 (pantothenic acid)
- Vitamin B6 (pyridoxine)
- Vitamin B12 (cyanocobalamin)
- Folic acid
- Biotin
- Vitamin C (ascorbic acid)

The World's Healthiest Foods provide all nutrients the cell needs to be healthy.



Refined foods are nutrient deficient. Cells become nutritionally deficient and start deteriorating.





- **Remember Proper Nutrition**

- **Maintains normal growth, health and reproduction.**

- **Rewards healthy and happy life**

- **Improves life span**

Remember
Defective Nutrition
Is Root Cause Of Many Disorders

How Should Be Our Eating?

One Should Eat

To Live

A Healthy and Happy Life

SOP's Of Eating Nutritive Food

- Simple
- Natural
- Balanced (Mixed)
- Appropriate quality and quantity
- Fixed
- Regular
- Timely
- Utilization of unutilized stores (Fasting)

Essentials for Healthy Life

- Ingest food Nutrients with
  - **Proportionate Quantity**
  - **Appropriate Quality**

- **Ignorance and wrong food habits** are

- Responsible for **most illnesses of Human being**

- **'Prevention Is Better Than Cure'**
  - **Good and Proper diet** is a best way to **prevent many diseases.**

- **A sound knowledge of nutrition to a doctor is of paramount importance**
  - To maintain his/her **own good health**
  - **Advice for planned diets/Moderate**, to **patients** to maintain their good health's.

DIETARY GOALS

Phase Wise Diet

- **Maintenance of a state of positive health and optimal performance** in populations at large **by maintaining ideal body weight.**

- **Ensuring adequate nutritional status for pregnant women and lactating mothers.**

- **Improvement** of **birth weights and promotion of growth of infants, children and adolescents to achieve their full genetic potential.**

- **Achievement** of **adequacy in all nutrients and prevention of deficiency diseases.**

- **Prevention of chronic diet-related disorders.**

- **Maintenance of** the **health of the elderly and increasing life expectancy**

Nutritional Goal Is To Accomplish

Structural Composition And Function Of Every Body Cell To best

- **Quantity** of food **promotes a constant BMI**

- **Quality** of food **promotes functionality**

DIETARY GUIDELINES
Do's and Don'ts Of Eating Food

- **Eat variety of foods** to ensure a balanced diet.

- **Ensure provision of extra food** and healthcare to **pregnant and lactating women.**

- **Promote exclusive breastfeeding for six months** and encourage continue **breastfeeding till two years** or as long as one can.

- **Feed home based semi solid mixed foods** to an infant **after six months**.

- **Ensure adequate and appropriate diets** for children and adolescents, both in health and sickness.

- **Eat plenty of vegetables and fruits**

- **Ensure moderate use of edible oils and animal foods** and

- **Very less use** of ghee/ butter

- **No use of Vanaspati/ trans fats**

- **Avoid undereating /very less eating to loose weight**.

- **Overeating to prevent overweight** and obesity

- **Exercise regularly and be physically active** to maintain ideal body weight.

- **Restrict salt intake to minimum**

- Ensure use of **safe and clean foods with natural antioxidants**

- Adopt **right pre-cooking processes** and appropriate cooking methods.

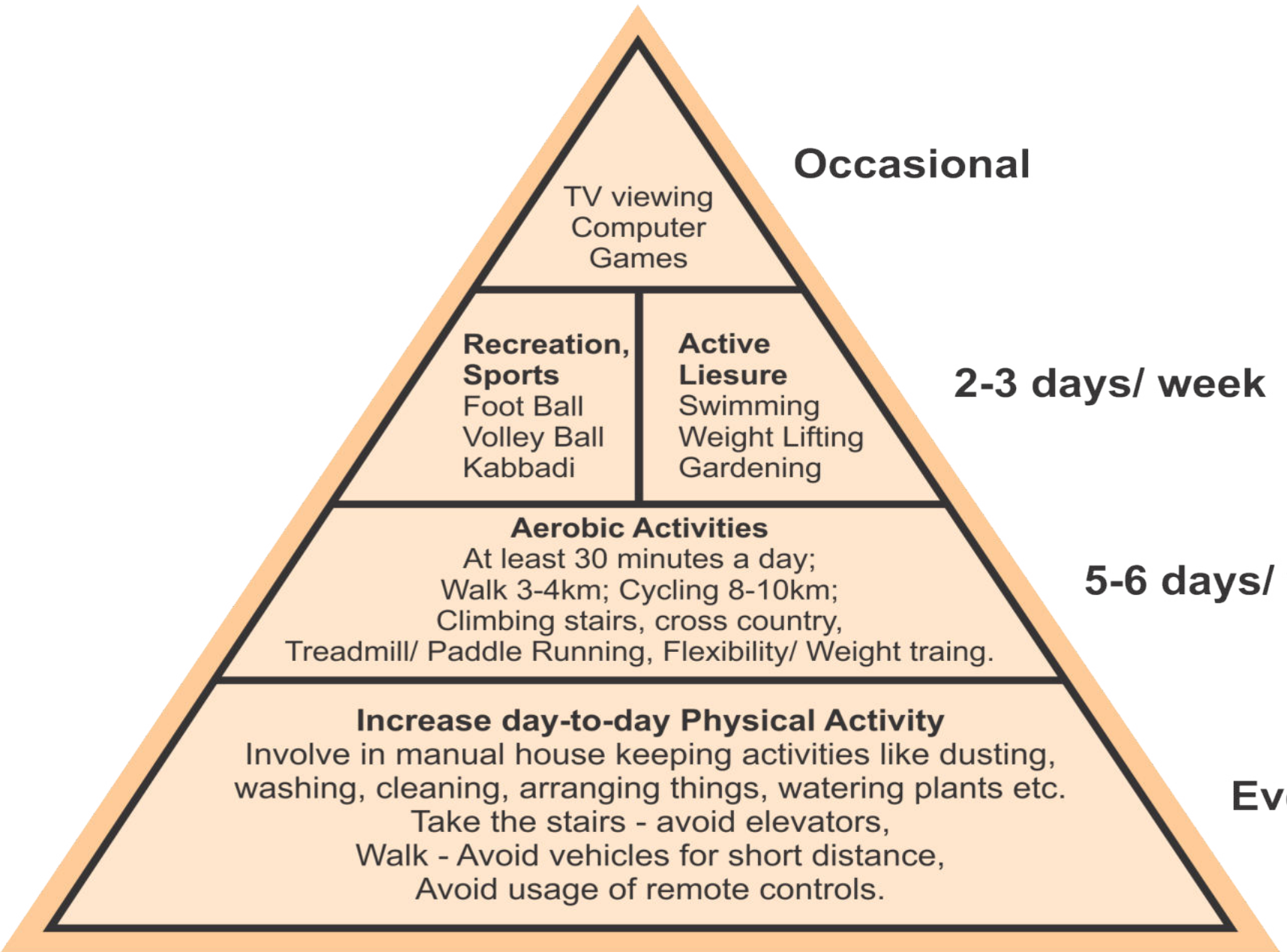
- **Drink plenty of clean water** and take **beverages in moderation**

- **Minimize the use of processed foods rich in salt, refined sugar and trans fats.**

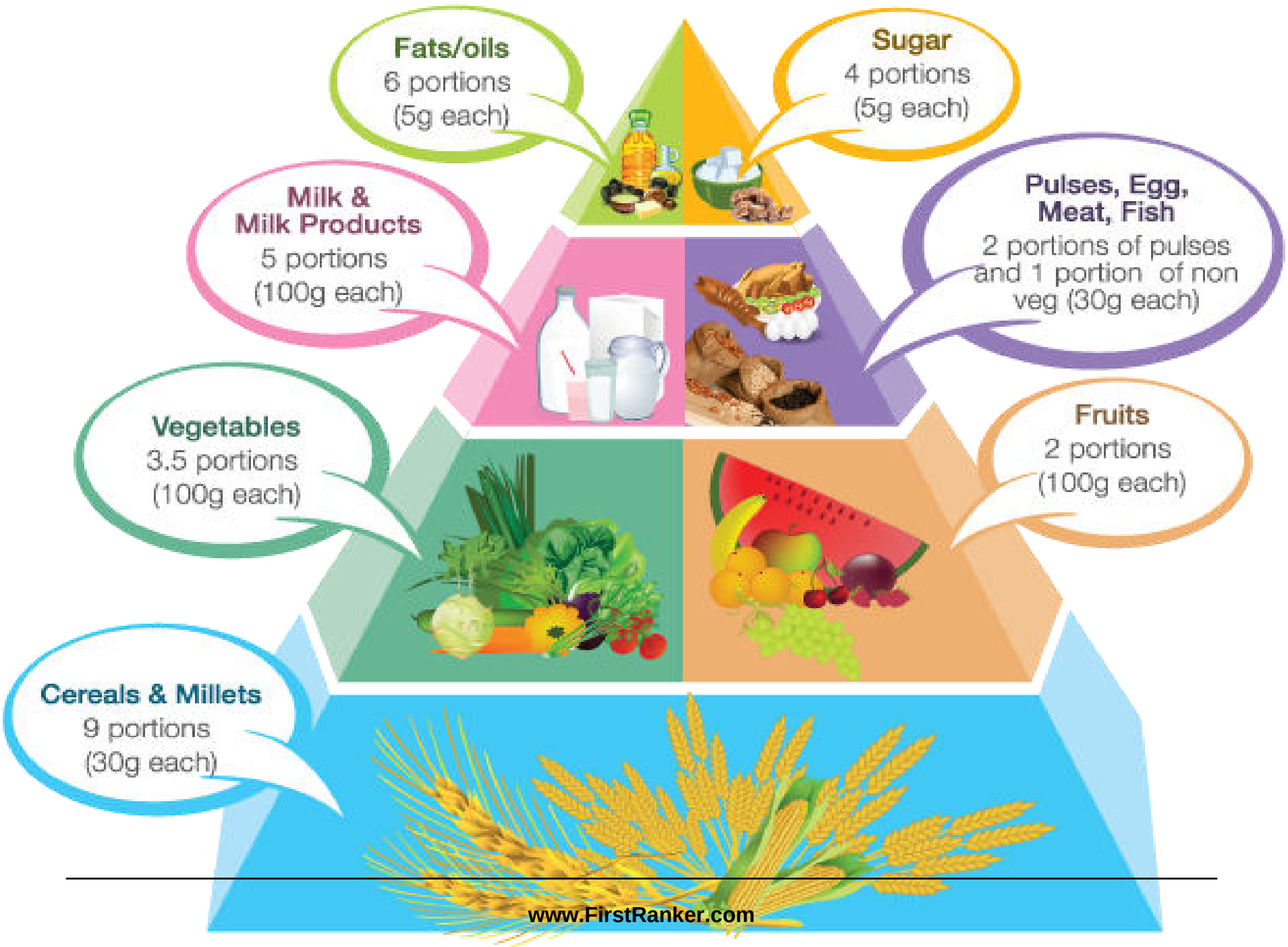
- **Include micronutrient-rich foods** in diets of elderly people to enable them to be fit and active

- **Nutrition Influences on:**
  - **Health**
  - **Appearance**
  - **Behavior**
  - **Mood**

Mixed Type Of Diet Is A Healthy Diet



Physical Activity Pyramid
(Source, NIN India)



Composition of Food and Their Role in Human Body or Nutritive Value of Nutrients

What To Eat? And What Not To Eat?

- **Nutrients** are organic or inorganic molecules

- **Crucially required for human growth & well-being.**

- Food items derived from **plant or animal sources contain nutrients**.

- **~ 40 nutrients identified and present in food items.**

Chief Nutrients Of Food Substances

Six Main Nutrients of Food Items

- Carbohydrates
- Lipids (Fats)
- Proteins
- Vitamins
- Minerals
- Water (Most Important)

Classification Of Nutrients

- There are four ways to classify 6 classes of nutrients:
  - I. Essential or Nonessential Nutrients
  - II. Organic or Inorganic Nutrients
  - III. Macronutrient or Micronutrients
  - IV. Calorific or Non calorific Nutrients

- **Essential Nutrients –**

- **Nutrients not biosynthesized in body** or cannot make enough of to meet the bodies need.
- **These nutrients must be obtained from foods.**

– Examples:

- **Vitamins**
- **Minerals**
- **Some of the amino acids and fatty acids.**

- **Nonessential Nutrients –**

- **Nutrients readily biosynthesized by body** from other ingested nutrients

→ Examples:

- **Cholesterol**
- **Non Essential Amino acids**
- **Non Essential Fatty acids**

- **Organic Nutrients** - contain carbon
  - **Carbohydrates**
  - **Lipids**
  - **Proteins**
  - **Vitamins**

- **Inorganic Nutrients** - do not contain carbon
  - **Minerals**
  - **Water**

- **Macronutrients-**
- Required in large quantities

–Carbohydrates
–Lipids
–Proteins
–Water

- **Micronutrients**
  - Required in small quantities.

– Minerals
– Vitamins

- **Energy-yielding nutrients /Calorific Nutrients:**
  - **Carbohydrates**
  - **Lipids**
  - **Proteins**

- **Non energy yielding/Non Calorific**
  - –Vitamins
  - –Minerals

Main Food Groups

Fruit and Vegetables

Fruits and vegetables grow on plants: underground, on the ground or in trees.

Every day we should eat at least 5 portions of fruit and vegetables. (A portion is about a handful.)

Fruit and vegetables give us fibre and vitamins and minerals.

Take 5 a day everyday!

Grains and Pulses

This food group includes wheat, corn, barley, rice, lentils, beans etc.

These are all from plants and form a staple part of the diet for people all over the world.

Grains and pulses give us carbohydrates and proteins.

Nuts are another source of protein.

What is..?

Rice is the staple food in China and much of the East. What is it in the West (UK, USA)?

Dairy Products

Dairy foods are made from milk (usually cow's milk, but can be from other animals like goats or sheep). Dairy foods give us proteins and fats. They are also a good source of calcium which is good for bones and teeth.

These foods include:

- **Cheese (hard, soft, cottage)**
- **Yogurt**
- **Food high in milk or milk products.**

Weird fact

Our brains are 80% fat.

Meat, Fish and Eggs

The main nutrients derived from meat are proteins, but it also gives us fats and some minerals.

The meat and fish group includes:

- **Chicken and all poultry**
- **Fish and shellfish**
- **Beef, pork and lamb**
- **Eggs are included in this group too.**

Athletes eat lots of protein; they help to build muscles.

Foodie fact

Sushi (raw fish) is now Marks and Spencer's best-selli lunchtime snack.

Nutrients

GROUPS OF NUTRIENTS:

- Carbohydrates
- Proteins
- Lipids
- Vitamins
- Minerals
- Water

Carbohydrates

- **Nutritional Carbohydrates:**

- **Sugars-simple Carbohydrates**

- **Starch-complex Carbohydrates**

- **Simple Carbohydrates:**
- **Mono and Disaccharides** include:
  - ❖ **Glucose**
  - ❖ **Fructose**
  - ❖ **Lactose**

❖ **Fruits,Milk,Juices and Sweets**

- Complex Carbohydrates are Present in
- **Starches**
- **Cellulose**
  - ❖ Legumes
  - ❖ Whole grains

- **Simple Carbohydrates**
  - pop, candy, sweets, fruits
  - Recent studies reported **Refined sugars are Brain damaging and Poisons**
- **Complex Carbohydrates**
  - pasta, rice, breads, potatoes

Dietary Fiber

- Dietary Fiber
- Indigestible complex Carbohydrate
- Non calorific

Substances As Dietary Fiber

- Cellulose
- Hemicellulose
- Pectin's
- Gum
- Lignin
- Mucilage

• Sources Of Dietary Fibers

- Richly present in **plant food substances.**
- **Poorly** present in **refined and commercial food products.**

Types Of Dietary Fibers

- **Soluble Dietary Fiber** –

- **Decreases Cholesterol levels**
- Found in oat bran, fruits and veggies

- **Insoluble Dietary Fiber**-

- **Reduces risk of colon cancer**
- Found in wheat bran and grains

- **Recommendation of Dietary Fiber:**
- **25-40 gm per day**

Check

are we getting enough

Dietary Fiber through foods ?

Ways to Get More Fiber

- Eat more fruits and vegetables
- Eat whole grain foods

Advantages Of Dietary Fiber

- Act as roughage
- Holds water
- Forms soft and bulky feces
- Increases bowel movement
- Easy defecation
- Prevents constipation

Advantages Of Dietary Fiber Contd---

- Dietary fiber corrects
  - –Hyperglycemia
  - –Hypercholesterolemia

Advantages Of Dietary Fiber Contd---

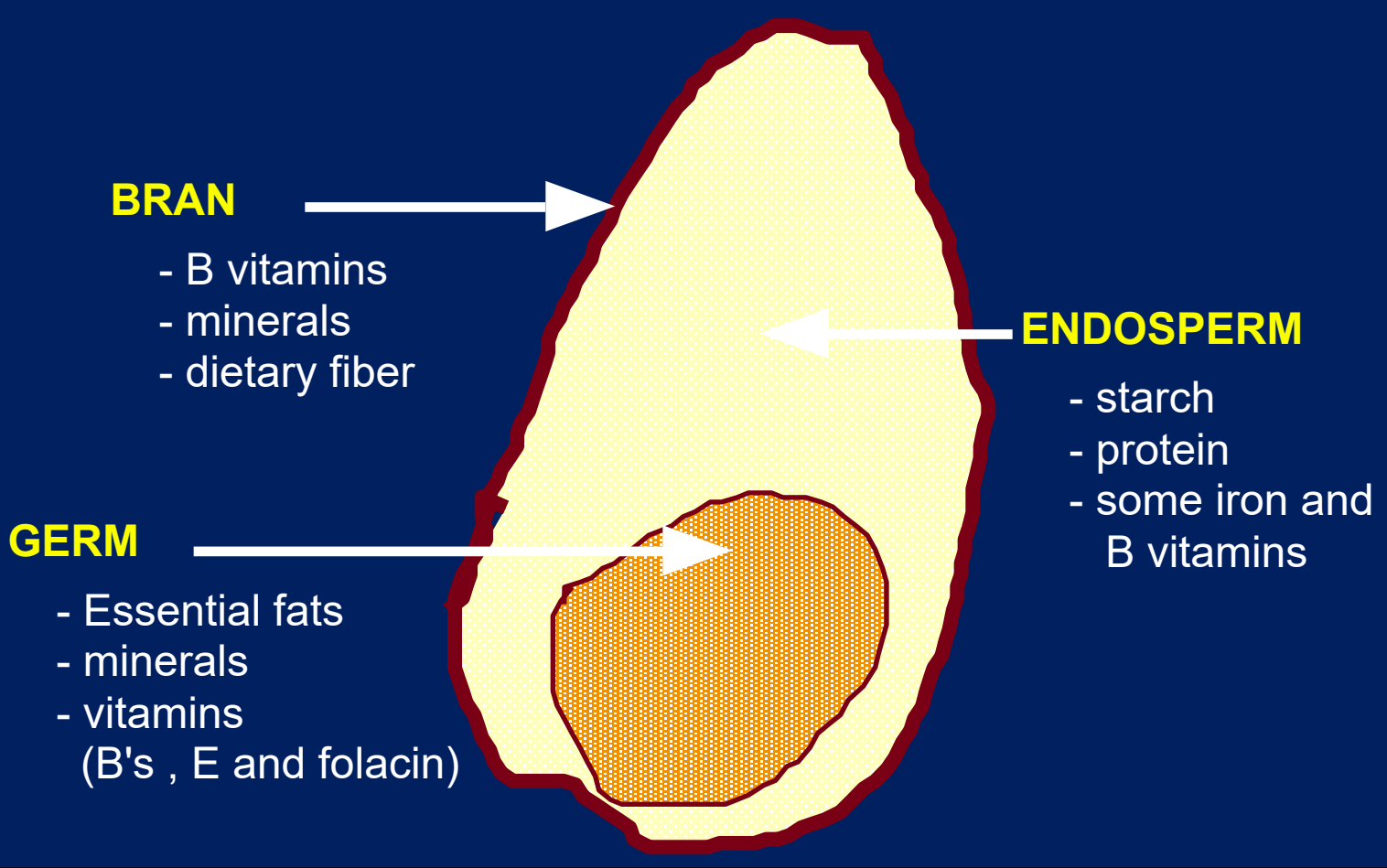
- **Fiber Reduces risk of:**
  - **–Diverticular disease of colon**
  - **–Colon cancer**
  - **–Varicose veins**

Advantages Of Dietary Fiber Contd---

- **Good satiety and non calorific value** of dietary fiber
- Helps in **management of obesity.**

Disadvantages Of Dietary Fiber

- It binds with **trace elements and reduces its absorption.**
- **Decreases** absorption of **fat soluble vitamins.**



- **Germinated legumes** have **partial dextrinization of Starch.**

- Which is **good for digestion, absorption and utilization**.

Role Of Carbohydrates

- Readily available source
- Supply primary energy needs
- Antiketogenic
- Build structure of cells
- Store calories as Glycogen
- Excess Carbs convert to Fat
- Amino acid synthesis
- Cellulose as roughage

Quantity And Quality Of Carbohydrates To Be Ingested

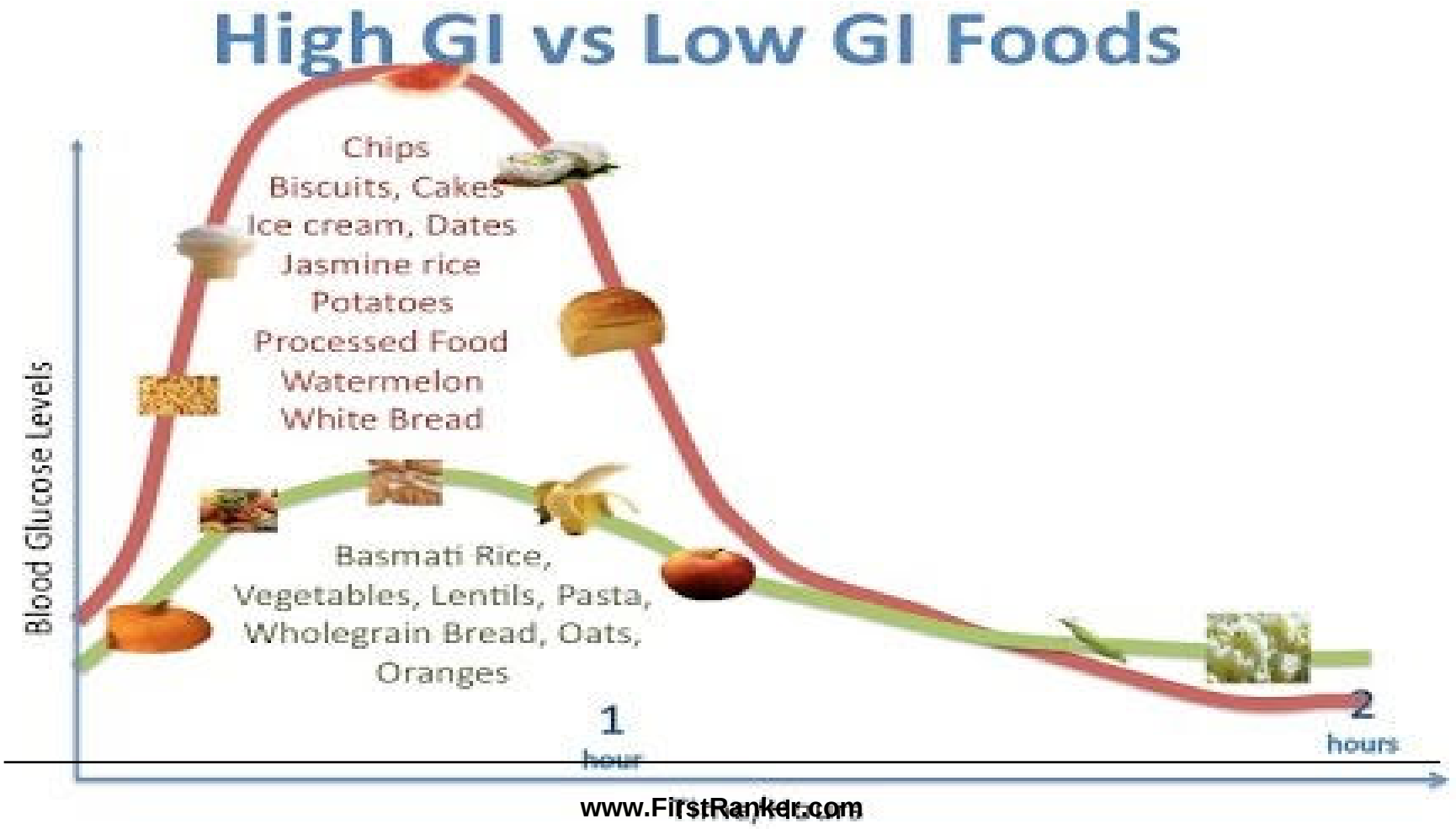
- **RDA for Carbohydrates- 400-600 gm/day**

- An Adult individual with his/her **routine activities should adjust** the Carbohydrates intake.

- Ingestion of **Starchy food is more preferable**.
- **Refined sugars have high glycemic index** so quantity should be reduced.
- **Excess of Glucose transforms** to **Lipids** viz Fatty acids,TAG,Cholesterol

- Dietary **fiber in form of Celluloses to be ingested.**

Hypoglycemia and Hyperglycemia Relates To Glycemic Index (GI) of Foods



Low Glycemic Foods List 0 - 55	Medium Glycemic Foods List 56 - 70	High Glycemic Foods List 70+
Most non starchy vegetable <15	Canned kidney beans 52	Bagel 72
Peanuts <15	Kiwifruit 52	Corn chips 72
Low-fat yogurt, no sugar<15	Orange juice 52	Watermelon 72
Tomatoes 15	Banana 53	Honey 73
Cherries 22	Potato chips 54	Mashed potatoes 73
Peas 22	Special K 54	Cheerios 74
Plum 24	Sweet potato 54	Puffed wheat 74
Grapefruit 25	Brown Rice 54	Doughnuts 75
Pearled barley 25	Linguine 55	French fries 76
Peach 28	Oatmeal cookies 55	Vanilla wafers 77
Can peaches, natural juice 30	Popcorn 55	White bread 79
Soy milk 30	Sweet corn 55	Jelly beans 80
Baby lima beans 32	Muesli 5	Pretzels 81
Fat-free milk 32	White rice 56	Rice cakes 82
Low-fat yogurt, with sugar 33	Pita bread 57	Mashed potatoes, instant 83
Apple 36	Blueberry muffin 59	Cornflakes 84
Pear 36	Bran muffin 60	Baked potato 85
Whole wheat spaghetti 37	Hamburger bun 61	Rice, instant 91
Tomato soup 38	Ice cream 61	French bread 95
Carrots, cooked 39	Canned apricots, light syrup 64	Parsnips 97
Apple juice 41	Macaroni and cheese 64	Dates 100
All-Bran 42	Raisins 64	
Canned chickpeas 42	Couscous 65	
Custard 43	Quick-cooking porridge 65	
Grapes 43	Rye crisp-bread 65	
Orange 43	Table sugar (sucrose) 65	
Canned lentil soup 44	Instant porridge 66	
Macaroni 45	Pineapple 66	
Pineapple juice 46	Taco shells 68	
Banana bread 47	Whole wheat bread 68	
Long-grain rice 47		
Bulgur 48		
Canned baked beans 48		
Grapefruit juice 48		
Green peas 48		
Oat bran bread 48		
Old-fashioned porridge 49		

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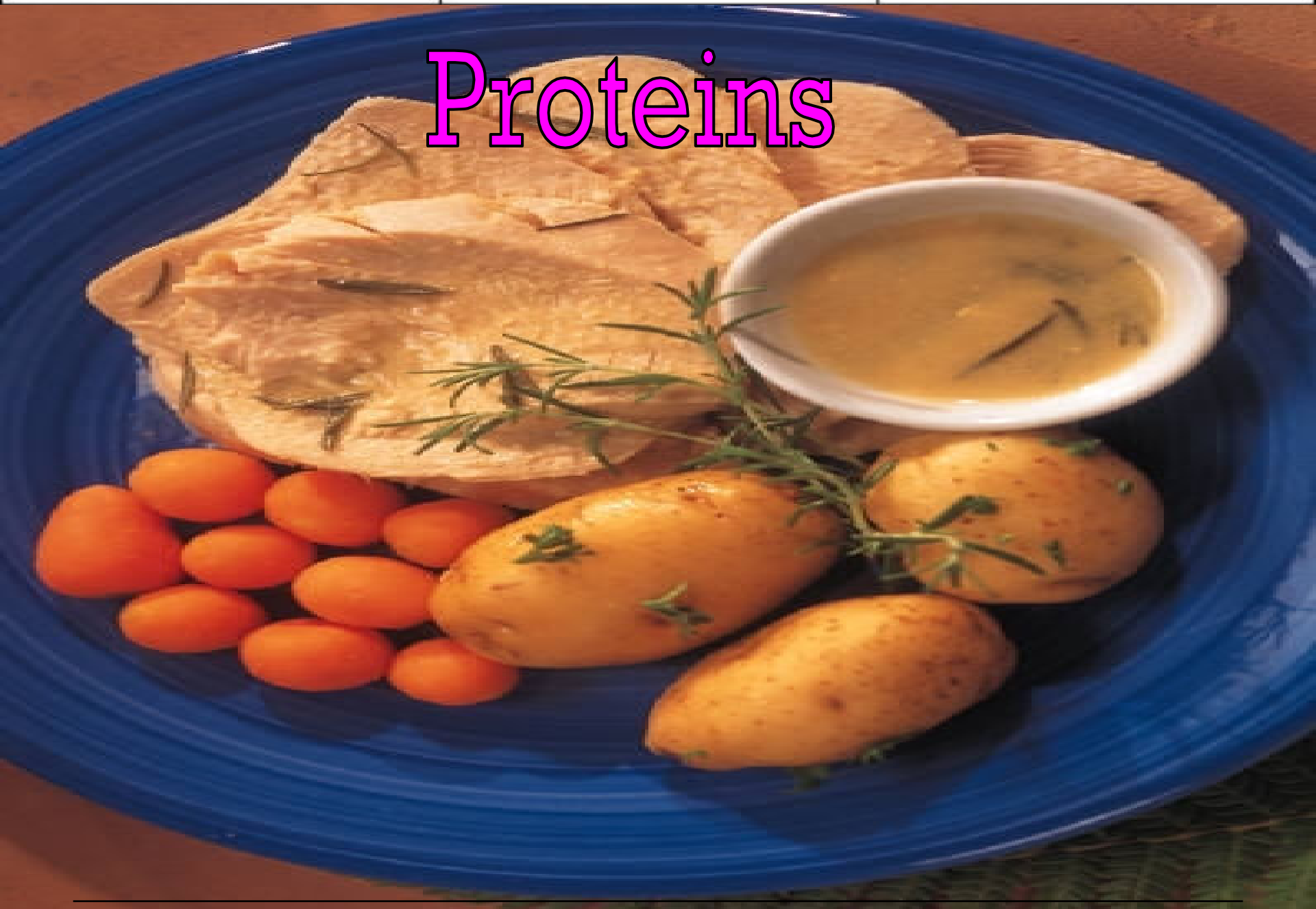


- **Dietary Proteins**

- **Provide essential amino acids**

- **Building blocks for tissue Proteins**

  - **Proteins are of structural and Functional importance**

  - Maintain **growth, repair and function** of the body cells and tissues.

Nutritional Classification Of Proteins

- **Dietary Proteins nutritionally classified into two groups:**
  - **Complete Proteins**
  - **Incomplete Proteins**

- **Complete Proteins/ First Class Proteins/High Biologically Valued**

- Complete Protein contains adequate amounts of **all essential amino acids.**

SOURCES INCLUDE:

Animal Origin Proteins

- Fish
- Meat
- Poultry Meat and Eggs,
- Milk, Cheese and yogurt
- Soya Bean products

• Incomplete Proteins

- **Incomplete Proteins lack one or more essential amino acids** (limiting amino acid).

SOURCES INCLUDE:

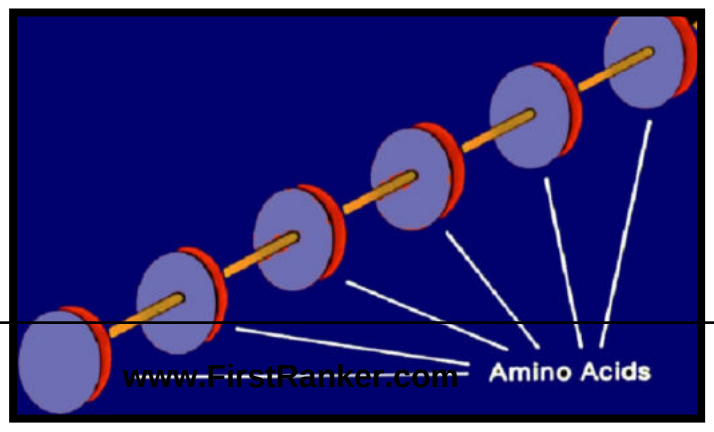
- Beans
- Pulses (Limit in Met)
- Nuts
- Whole grains (Limit in Lys and Thr)

• Types of Amino Acids (20 AA)

– **Nutritionally Nonessential AA (10)** – can be biosynthesized by body

– **Nutritionally Essential AA (8)** – Not biosynthesized must be made available through diet

– **Nutritionally Semi-essential AA (2)-** Made in body to less amount need also from diet



Dietary Protein Requirements

- RDA average = 0.8-1.0 g/kg body weight/Day
- RDA Athlete = 1.2-1.6 g/kg/day

- High levels of Dietary Protein intake above 2 g/kg/day can be harmful to the body

Evaluating Protein Quality

- **Biologic Value (BV) of Protein:**

- **Amount of ingested Nitrogen retained in the body compared with Nitrogen absorbed.**

Biological Value Of Proteins

- Dietary Proteins differ in their **quality i.e**
- **Efficiency of digestibility and absorption capacity.**

- An **effectiveness of dietary Protein** is in
- **Providing amount of essential amino acids** for tissue Protein biosynthesis.

Biological Value = Nitrogen Retained x 100

Nitrogen Absorbed

Biological Value of Protein is Percentage of Nitrogen absorbed and retained in the body.

Biological value of protein

% of protein nitrogen absorbed that can be retained in the body.

$$\text{Biological value of protein} = \frac{\text{retained nitrogen}}{\text{absorbed nitrogen}} \times 100$$

$$\text{Protein Efficiency Ratio (PER)} = \frac{\text{weight increased}}{\text{grams of protein increase}}$$

$$\text{Net Protein Utilization (NPU)} = \frac{\text{Digestibility coefficient} \times \text{Biological value}}{\text{Protein intake (gm)}}$$

- **Thus BV of Protein** indicates effectiveness of utilization of dietary Proteins

- **Proteins** with **high biological value**(B.V) are also termed as:
  - **Superior Proteins**
  - **Complete proteins**
  - **First class Proteins**

- All **animal origin Proteins** rich in all essential amino acids **are of high B.V.**

- Dietary Proteins with high biological value
- **Support good tissue biosynthesis and retain the Proteins in body for their functional use.**

- **Net Protein Utilization (NPU):**
  - Percentage of Nitrogen consumed that is retained in the body.

- **Biological value of protein affects Nitrogen balance.**

  – Low B.V proteins leads to **negative nitrogen balance.**

  – **Increased loss of** NPN substance **Urea in urine.**

- **Plant proteins** are of **low B.V**

- Since **deficient in one or two essential amino acids.**

- **Complete Proteins** with **high biological value**

- **Maintain Positive/Nitrogen equilibrium**

Source Of Protein	B.V	Limiting Amino acid
Egg	94	Nil
Milk	84	Sulfur containing amino acids
Fish	85	Tryptophan
Meat	75	Sulfur containing amino acids
Soya Beans	65	Sulfur containing amino acids

Source Of Protein	B.V	Limiting Amino acid
Rice	68	Lysine and Threonine
Wheat	58	Lysine and Threonine
Pulses	58	Sulfur containing amino acids

NUTRITIONAL BENEFITS OF PULSES

Malnutrition

Is the result of **eating too little, too much or eating an unbalanced diet** that does not contain the right quantity and quality of nutrients to be healthy.

The role of pulses

They are a vital source of plant-based proteins and amino acids for people around the globe and **should be eaten as part of a healthy diet to address obesity, as well as to prevent and help manage chronic diseases**.

MANY CAN BENEFIT FROM **EATING PULSES**

Infants and young children, to meet their daily nutritional needs.

Vegetarians and vegans, to ensure adequate intakes of protein, minerals and vitamins.

Women at reproductive age, when combined with Vitamin C, pulses' high iron content makes them a potent food for replenishing iron stores.

Coeliac patients, pulses are gluten-free.

THE MANY **HEALTH BENEFITS** OF PULSES

High in dietary fibre
May reduce the risks of coronary heart disease.

Calcium content
The calcium found in pulses contributes to promoting bone health and reducing the risk of osteoporotic fractures.

Rich in phytochemicals and antioxidants
May contain anti-cancer properties.

Presence of Phytoestrogens
May prevent cognitive decline and reduce menopausal symptoms.

Low glycaemic index, low fat & high in fibre
Increases satiety and helps to stabilize blood sugar and insulin levels, making them suitable for people with diabetes and ideal for weight management.

High iron content
Good for preventing iron deficiency anaemia in women and children, when combined with Vitamin C.

Source of vitamins, such as folate
Reduces the risk of neural tube defects (NTDs) like spina bifida in newborn babies.

GETTING THE MOST FROM YOUR PULSES

When other foods are combined with pulses, the nutritional value of pulses is further enhanced or lowered.

Pulses + Grains
The overall protein quality is improved. ↑

Pulses + Vitamin C
Another way of increasing the body's ability to absorb iron (lemon juice on lentil curry for example). ↑

Pulses + Tea/Coffee
Decreases the body's ability to absorb iron and the minerals. ↓

Food and Agriculture Organization of the United Nations

2016 INTERNATIONAL YEAR OF PULSES

#IYP2016
fao.org/pulses-2016

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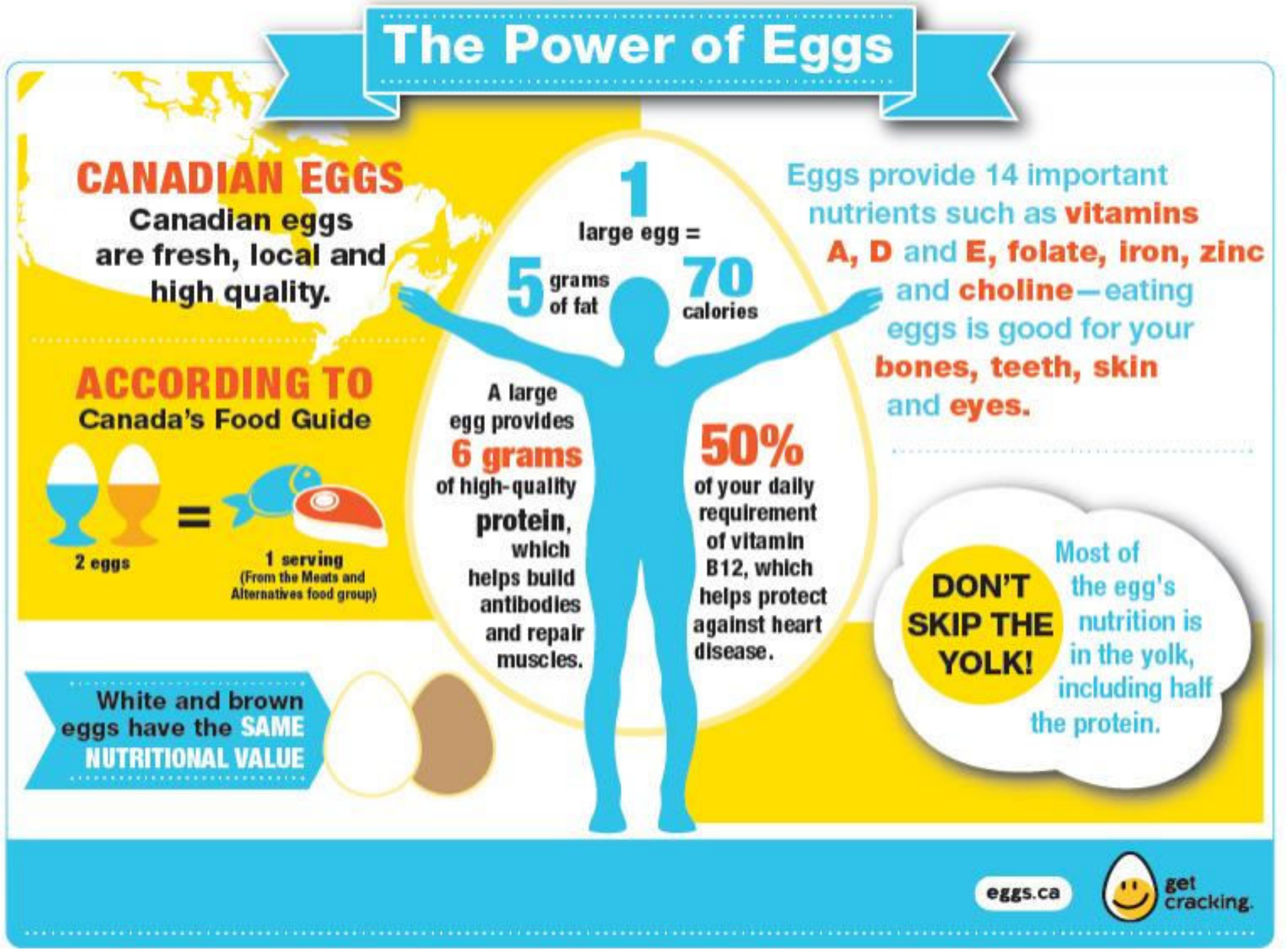


Mutual Supplementation Of Dietary Proteins Improves Biological Value Of Proteins

- Eating combination of **Pulses** and **Grains provides all required essential Amino acids** for tissue Protein biosynthesis.
  - Dal and Roti
  - Rice and Dal
  - Idli and Sambhar
  - Rajma Chanwal
  - Chhole Chanwal

Functions Of Dietary Proteins

- **Supply amino acids** for **growth & repair of body tissues**
- Biosynthesize all tissue Proteins
  - **Hemoglobin**
  - **Nucleoproteins**
  - **Glycoprotein**
  - **Lipoproteins**

- Protein **serve as a source of energy :**
  –When there is **shortage of Lipids & Carbohydrates** in the body.

- Proteins has **role in metabolism osmoregulation ,transport and acid-base balance**

- Enzymes
- Hormones
- Antibodies
- Receptors
- Transport Proteins
- Osmotic Proteins
- ETC Components
- Collagen (bones)
- Keratin (nails & hair)

LIPIDS

- Dietary lipids **predominantly** contains **Triacylglycerol** (TAG).

- TAG to human body serves as a **secondary source of energy** on long term basis.

- TAG stored as **reserve food in adiposecytes**
- Provides energy in **between meals , fasting and starvation condition**.

- The other forms of dietary lipids viz
- **Phospholipids and Cholesterol** has structural and functional role in the body.

- Fats/Oils are type of neutral lipids, insoluble in water.
- **Fatty acids** are the building blocks of various tissue Lipids .

Types of Fatty Acids

- **Saturated Fatty Acids**
  - Animal sources
  - **Solid at room temperature**
  - High intake is associated with an **increased risk of heart disease**
- **Unsaturated Fatty Acids (MUFAS and PUFAS)**
  - Vegetable sources
  - Liquid at room temperature
  - Associated with a **reduced risk of heart disease**
- **Trans Fatty Acids**
  - Hydrogenation to alter "state" of fat example **Vanaspati Dalda**
  - **Increase shelf-life & market availability**
  - **Repeated heating of Oils**

Composition of Oils (%)

Type	Sat	Poly	Mono
safflower	09	75	16
sunflower	10	66	24
corn	13	59	28
soybean	14	58	28
sesame	14	42	44
peanut	17	32	51
palm	49	09	42
olive	14	08	78
canola	07	35	58

- Those **Fatty acids** are considered as **good**
- Who on entry in body **get easily metabolized** and give good effect to body.

- Those **Fatty acids** are **considered as bad**
- Which are **more stable and** get **less metabolized** and **remain for long time** in the body.
- As the fatty acids remain for long time it **increases the risk of Atherosclerosis**.

Quality and Quantity Of Dietary Lipids

- **Quantity of Dietary Lipids 60 gm/day**
- **Quality of Dietary Lipids:**
  - **TAG** with **mixture of Fatty acids linked**
  - Fatty acids in ratio of **MUFA:PUFA:SFA 1:1:1**
  - **Zero Trans Fatty acids**
  - **Equal proportion of Antioxidants To protect In vivo PUFA's**
  - **Adequate Carbohydrate Diet-No too much excess of Glucose to transform into Fatty acids and Cholesterol**

- **Fatty food is associated**

–With **fat soluble vitamins** A, D, E, and K

–**Sources of Linoleic acid-** essential fatty acid that is needed for growth and healthy skin.

Recommendations for Fat Consumption

- **Dietary Fat Recommendations**

- **Less than 30% of calories** in diet from dietary Lipids.
- Less than 1/3 of dietary fat should be saturated.

- **Ways to Decrease Intake of Fat**
  - –Minimize **"fast" foods and Snacks**
  - –Minimize **processed foods**
  - –Use **better cuts of Red meat**
  - –Use **low fat alternatives**
  - –**No Pork Meat/ Fat**
  - –**Choose foods with "Natural Lipids"**

Food s Should be rich In Essential Fatty Acids (EFAs)

- Linoleic acid (LA)
- Linolenic (LNA) or Alpha Linolenic acid or (ALA)
- Arachidonic Acid

Omega-3 and Omega-6 Fatty acids

- **Linolenic Acid** (18:3n-3) belongs to the omega-3 family of fatty acids

- **Linoleic Acid** (18:2n-6) belongs to the omega-6 family

Role Of Essential Fatty Acids (EFAs)

- **LA can be converted to both Arachidonic and Linolenic acids**
- Essential FA are necessary for **growth, skin & hair integrity.**
- Regulation of **Cholesterol metabolism.**
- **Lipotropic activity**
- **Decreased platelet adhesiveness and reproduction**.

- **Rich Dietary Sources of Linoleic Acid :**
  - **Soya oil**
  - **Sunflower oil**
  - **Safflower oil**
  - **Sesame seeds**
  - **Corn oil**
  - **Most nuts**

- **Dietary Sources Of Linolenic Acid :**
  - **Flax seeds(abundantly)**
  - **Walnuts(Small quantities)**
  - **Cold pressed Canola oil**
  - **Wheat germ**
  - **Dark green leafy vegetables**

- **Diets with <1-2% EFAs will affect growth rate, cause dry scaly rash and poor wound healing**

- The right ratio of LA to ALA in the diet
- About 3:1 or 2:1, is important
- An imbalance in the ratio
- May lead to a variety of mental disorders,
- including hyperactivity, depression, brain allergies, and schizophrenia

• Docosa Hexenoic Acid (DHA-C22)

- Is high in the phospholipids **of brain gray matter** .
- DHA is rich in **Algae and Fishes**
- It is the main component of CNS importance for its function
- **Depletion of DHA in the brain can result in learning deficits/Cognitive Function**.

- **DHA** appears to be important for visual and neurological development

- **EPA** and **DHA** supplementation during pregnancy
- Has evidenced beneficial effects on long-term cognitive development in children

Functions Of Lipids

- A concentrated & reserve secondary source of energy
- Physical protection for vessels, nerves, organs
- Insulate against changes in temperature
- Structure of body tissues, cell membranes & nuclei
- Carry the fat-soluble vitamins (A, D, E, K)
- Give appetite appeal
- Aid satiety (delay emptying time of the stomach)
- Spare Protein
- Supply Linoleic acid, the other essential fatty acids.

- High intake of **animal origin food is linked** to **increased blood Cholesterol .**
- Excess Cholesterol can lead to an **increased risk of Atherosclerosis and heart disease.**

Vitamins and Minerals

Vitamins

- Organic substances that are vital for human body.

- Vitamins are **accessory growth factors to human body.**

- **Vitamins are classified into two groups:**

- **Water-soluble Vitamins:**

- Vitamins dissolve in water and pass easily into the blood during digestion.
- The body does not store these so they need to be replenished regularly.
- Includes **vitamins C, and Vitamin B Complex** members B1 ,B2, B3,B5, B6, Folic acid, and B12.

- Excesses of water soluble vitamins will be excreted in the urine.
- However, B-6 and Niacin can be toxic when ingested in unusually large amounts.

- **Fat-soluble vitamins**

- These include vitamins A, D, E, and K.
- These Vitamins are absorbed, stored, and transported through dietary fat.
- Body stores these vitamins in fatty tissue, liver, and kidneys.
- Excess buildup in tissues can be

Fat Soluble Vitamins

- Consist of Vitamins A, D, E, and K
- Absorbed at the small intestine in the presence of bile (and fatty substances).
- Overdoses can be toxic (A and D)

Vitamin Supplementation?

- Not necessary if diet is healthy
- Multivitamins are safe (100% RDA)
- Not all vitamins are “pure”
- Can be toxic at high doses

Vitamin A	Role in vision, growth and differentiation of germinal epithelial cells, anticancer	Fish Liver Sweet potatoes, Carrots
Vitamin B	Form Coenzymes, help enzymes in metabolic reactions	Green leafy vegetables, Fruits, yeast
Vitamin C	Collagen synthesis, Steroidogenesis, Iron metabolism, Healing skin, preventing colds	Citrus fruit, tomatoes
Vitamin D	Calcium metabolism, Strengthen bones	Milk Sunlight
Vitamin E	Potent Antioxidant, Helps strengthen cells	Vegetable Oils, nuts

- Most of the **vitamins except very few are not biosynthesized in human body.**
- Vitamins are **associated with various plant and animal origin foods of nature.**
- Ingestion of foods rich in vitamins is mandatory for a good health.
- Vitamins helps to **maintain growth ,health and reproduction**.
- They do not generate calories/Non calorific
- Most Vitamin B complex members **serve as Coenzymes for Enzyme action.**

- **Vitamins** help to regulate many vital body processes that include:
  - **Digestion**
  - **Absorption**
  - **Metabolism**
  - **Bone Ossification**
  - **Vision**
  - **Antioxidant role**

Minerals

Minerals

- Inorganic elements found in food that are essential for life processes
- About 25 are essential Minerals

- Minerals are classified as:
  - Macro minerals
  - Trace minerals

- **Macro Minerals: S**odium, Potassium, Chloride, Calcium, Phosphorus, Magnesium, Sulfur
- **Trace Elements:** Iron, Zinc, Selenium, Molybdenum, Iodine, Copper, Manganese, Fluoride, Chromium

Macro Minerals

- **Calcium**
- Is needed for bone and teeth rigidity
- Helps in blood clotting,
- Muscle contraction & normal nerve functions.

- **Phosphorous**
- Helps build strong bones & teeth
- Forms various Phosphorylated compounds.

- **Sodium, Chloride, Potassium**
- **Serve as body Electrolytes**
- Work together to regulate the fluids in the body
- Help regulate the nervous system, muscle functions & nutrient absorption in the cells

- **Magnesium**

- Helps regulate body temperature,
- Muscle contractions & the nervous system
- Helps cells metabolize Carbohydrates, Fats, and Proteins

- **Sulfur**

- Helps in detoxification reactions (PAPS)
- Is present in sulfur containing amino acids in proteins
- A component of constituents of mucopolysaccharides & essential compounds

Microminerals

- **Iron** combines with Protein to form Hemoglobin
- **Iodine** is needed by Thyroid gland to produce Thyroxine
- **Copper** is necessary in formation of Hemoglobin
- **Fluorine** helps reduce incidence of tooth decay
- **Zinc** plays an important role in the formation of protein
- **Zn assists** in wound healing, blood formation and general growth & maintenance of all tissues

- **Cobalt** is a component of vitamin B12
- **Manganese** is necessary for normal development of bones and connective tissues
- **Chromium** maintains normal glucose uptake into cells & helps insulin bind to cells

- **Selenium** along with vitamin E protects cells from destruction.
- Glutathione Peroxidase contains Selenium.
- **Molybdenum** is a component of Xanthine oxidase and Aldehyde oxidase

- **Functions Of Minerals**

- Body cannot manufacture Minerals but are needed for forming healthy bones and teeth .
- Regulate many vital body processes.
- Aids in muscle function
- Help transmit messages in nervous system

Mineral Guidelines

- Dietary supplementation of Calcium is beneficial for post-menopausal women
- **Salt should be limited in diet of hypertensives.**

Calcium

- Important for preventing osteoporosis
- RDA = 800-1000 mg/day
- Found in dairy products and vegetables

High protein diets leach calcium from bones and promote osteoporosis

Iron

- Important component of hemoglobin
- Iron deficiency is known as anemia

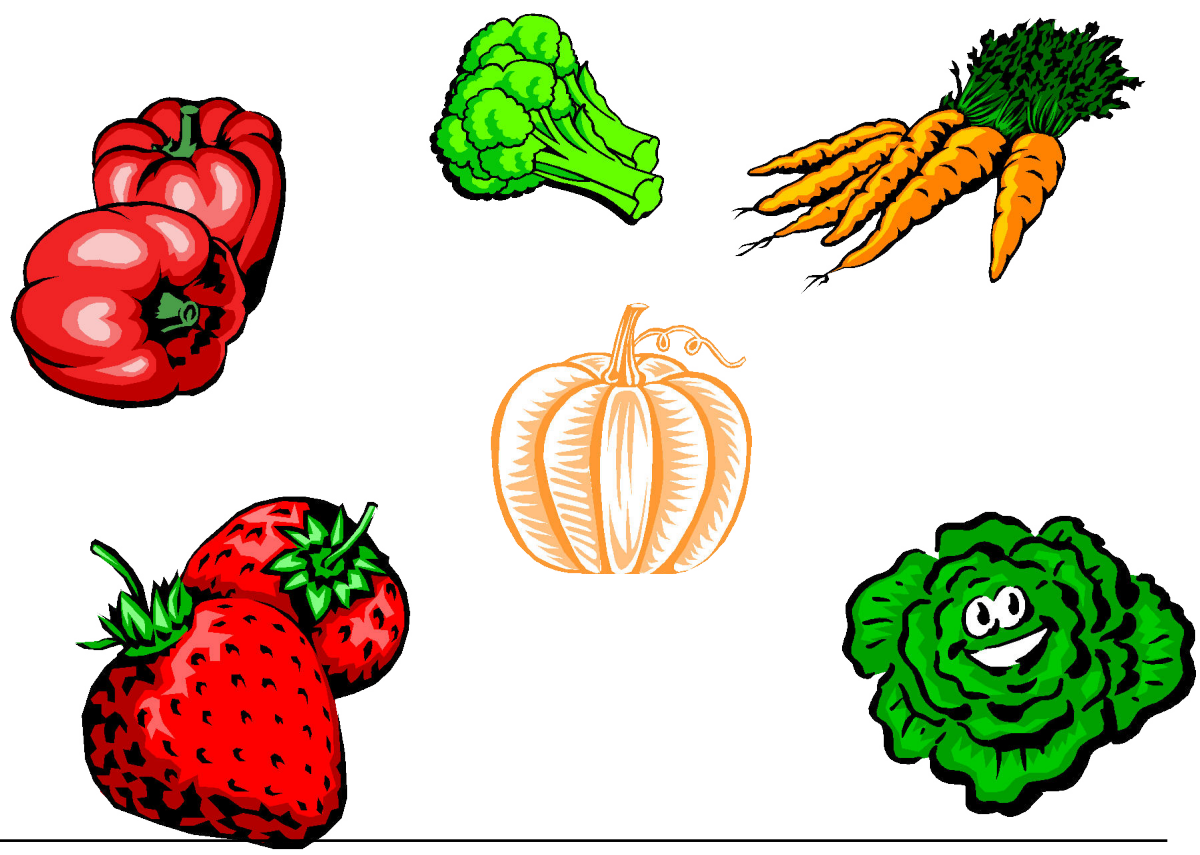
(Symptoms: shortness of breath, fatigue)

Antioxidants

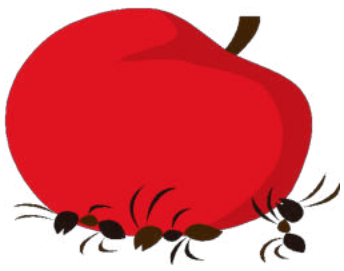
- Antioxidants are chemical substances which defend free radical activities.
- Antioxidants prevents Peroxidation of biomolecules –PUFA,DNA etc
- Antioxidants protect membrane damage.
- Antioxidants prevent Oxidative Stress.

Dietary Sources Of Antioxidants

- **Pigmented Fruits and Vegetables**
- Broccoli
- Bananas
- Berries
- Cherries
- Cantaloupe
- Carrot
- Mango
- Papaya
- Pumpkin
- Red Pepper
- Spinach
- Strawberries
- Sweet potato



Fresh Fruit and Vegetables



These contain Fibre ,Minerals, Vitamins and Antioxidants

Water

- Water makes up around **65% of body weight**

Remember

- It's important to drink **at least 8 glasses of water a day** to maintain health.

Role Of Body Water

- Water is essential to keep the body healthy.
- It helps to **cook** , **swallow and digest food**.
- It keeps the **body hydrated.**

- **Water Helps to Maintain Many body functions.**

- Chief component of blood plasma which **serves as** a **transport media**
- **Bodies solvent** helps in **metabolic reactions**(**Hydrolase and Hydratase**)
- **Lubricates joints** and **mucous membranes**

- **Serve as Shock absorber** in eyes, spinal cord, and amniotic sac (during pregnancy).

- Absorb , transport and **eliminate nutrients and metabolic wastes.**

- Perspiration/sweating helps to maintain **normal body temperature.**

Remember

- **Man** can **live for many days without food**,

- But **cannot live few days without water**.

Calorific Values Of Food Constituents

OR

Energy Content Of Food Nutrients

Calorimetry

- **Calorimetry** is a term used to **measure energy content of food nutrients.**

- **Calorific value of food is defined as :**
- An **amount of energy released by combustion of 1 gram of nutrient (Carbohydrate/Lipid/Protein)**

Determination Of Calorific Values of Food

Instrument Used For
Nutrients Energy Measurement

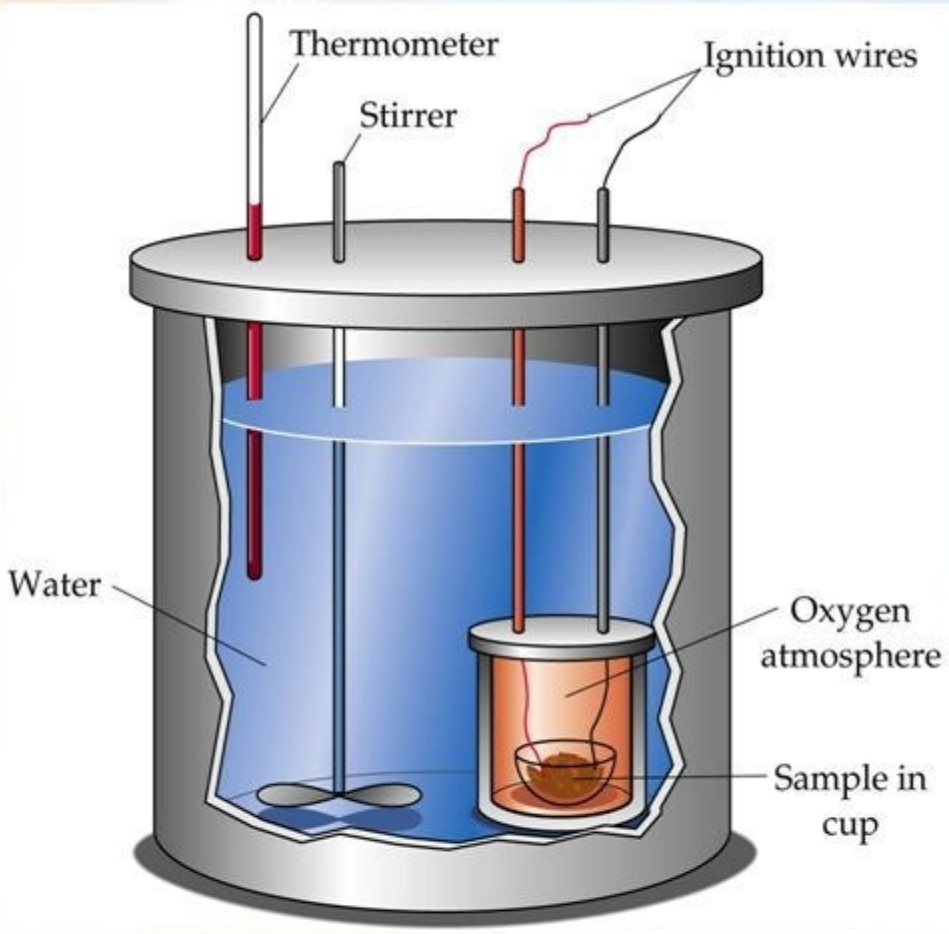
OR
Computing Calorific Values Of Nutrients

- **Bomb Calorimeter** is an instrument used to **determine Calorific values of food nutrients.**

What Is Bomb Calorimeter?

Bomb Calorimeter

- Material is combusted (burnt) inside a bomb calorimeter
- Box is sealed, with oxygen atmosphere
- Burnt material heats the water
- Energy change is found from temp change of water
- Constant volume, not constant pressure, so gives $\triangle E$ ($\triangle H = \triangle E + P\triangle V$)



Bomb Calorimeter

- **It is a closed metallic Oxygen chamber with electrically heated platinum wires.**
- **When food is placed inside it and operated**
- **It combust Nutrients placed inside it and determines calorific value of foods.**

- **Nowadays** there are **highly automated efficient combustion Calorimetric systems** available
- **To compute an energy contents of food and body.**

Unit For Measuring Calorific Values Of Food Nutrients

Calorie/kilocalorie

- **Calorie /kilocalorie is a Unit for measuring heat energy,** of food and energy requirement for body.
- **When you hear "Calorie," it is really a Kilocalorie**

Is There Any Difference Between Calorie and kilocalorie?

- “**Calorie**" we refer to in food is actually **kilocalorie**.
- One (1) **kilocalorie** is same as one (1) **Calorie**(upper case C).
- **Calories** and **kilocalories** are used interchangeably to mean same thing.

Calorie and Kilocalorie

- “Calories" **when we're talking about food**
- **"kilocalories" when we're talking about exercise**

Definition of Calorie

- **1 Calorie** is **amount of heat required to raise temperature of 1 gram of water with 1 degree Celsius.**

Calorific Values of Nutrients

- **Macronutrients (Calorific Values):**

  –**Fats = 9 Cal/g**

  –**Carbohydrates = 4 Cal/g**

  –**Proteins = 4 Cal/g**

  (5.3 Cal/g in Bomb Calorimeter)

- **Carbohydrates and Fats are completely oxidized** in body to **CO_2 and H_2O.**

- **Proteins are not completely oxidized in the body.**

- **Nitrogenous excretory product Urea, still contain oxidizable carbon and hydrogen in it.**

- **Micronutrients (Non Calorific)**
  - **Vitamins = 0 Cal/g**
  - **Minerals = 0 Cal/g**
  - **Water = 0 Cal/g**

Calculation of Calorific Value of Food Stuffs

- Food energy is an **amount of energy liberated by food nutrients.**

- **Through digestion absorption and assimilation of food nutrients.**

Calorific values of Foods

- Food Items contain **mixture of nutrients.**

- Calorific value of foods depends upon **an amount of nutrients present in it.**

From Total Energy Content
50-60 % Of Energy
Is Provided By Carbohydrates

Energy is provided by the following

Carbohydrates: (Primary Source)

Energy Provided 60% (45-65%) of the diet

1gm provides 4 kcal

Fats:

Energy Provided 35% (25-45%) of the diet

1gm short-chain provides 5.3 kcal

1gm medium-chain provides 8.3 kcal

1gm long-chain provides 9 kcal

Proteins:

Energy Provided 11% (9-15%) of the diet

1gm provides 4 kcal

How To Calculate Energy Content Of Foods?

Calculate Calorific Value of 100 gm Wheat Flour?

100 gram of Wheat Flour Contains

- **69.6 gm Carbohydrates**
- **12.0 gm Proteins**
- **1.5 gm Fat**

- Calories of 100 gm Wheat flour= (69.6x4)+(12x4)+(9x1.5)=**340 Calories**

- **Energy Content of foods is computed as:**
- **Multiplying amounts of calorific nutrients in 100 gm of food with their physiological calorific values.**
- **Finally adding up their values.**

Energy Requirements by A Human body

- **Human body daily requires** sufficient **amount of energy** to expend on **various body activities.**
- **This energy need is provided by combustion/oxidation of food nutrients of calorific values**.
  - **Usually Carbohydrates and Fats**
  - **In Emergencies Proteins**

Energy Requirement By Human Body Differs In Different Phases Of Life

- Approximately **80-120 kcal/kg body weight** for **1st year of life**.

- Approximate **2500 Kcal/day for an Adult individual**

Estimated Calorie Needs per Day by Age & Gender

Estimated amounts of calories[1] needed to maintain calorie balance for various gender and age. The estimates are rounded to the nearest 200 calories for assignment to a USDA Food Pattern. An individual's calorie needs may be higher or lower than these average estimates based on activity level.

	Female	Male
Age (years)	**Calories (per day)**	
2-3	1,000	1,000
4-8	1,200 - 1,400	1,200 - 1,400
9-13	1,400 – 1,600	1,600 – 2,000
14-18	1,800	2,000 – 2,400

[1] Based on Estimated Energy Requirements (EER) equations, using reference heights (average) and reference weights (healthy) for each age-gender group. For children and adolescents, reference height and weight vary.

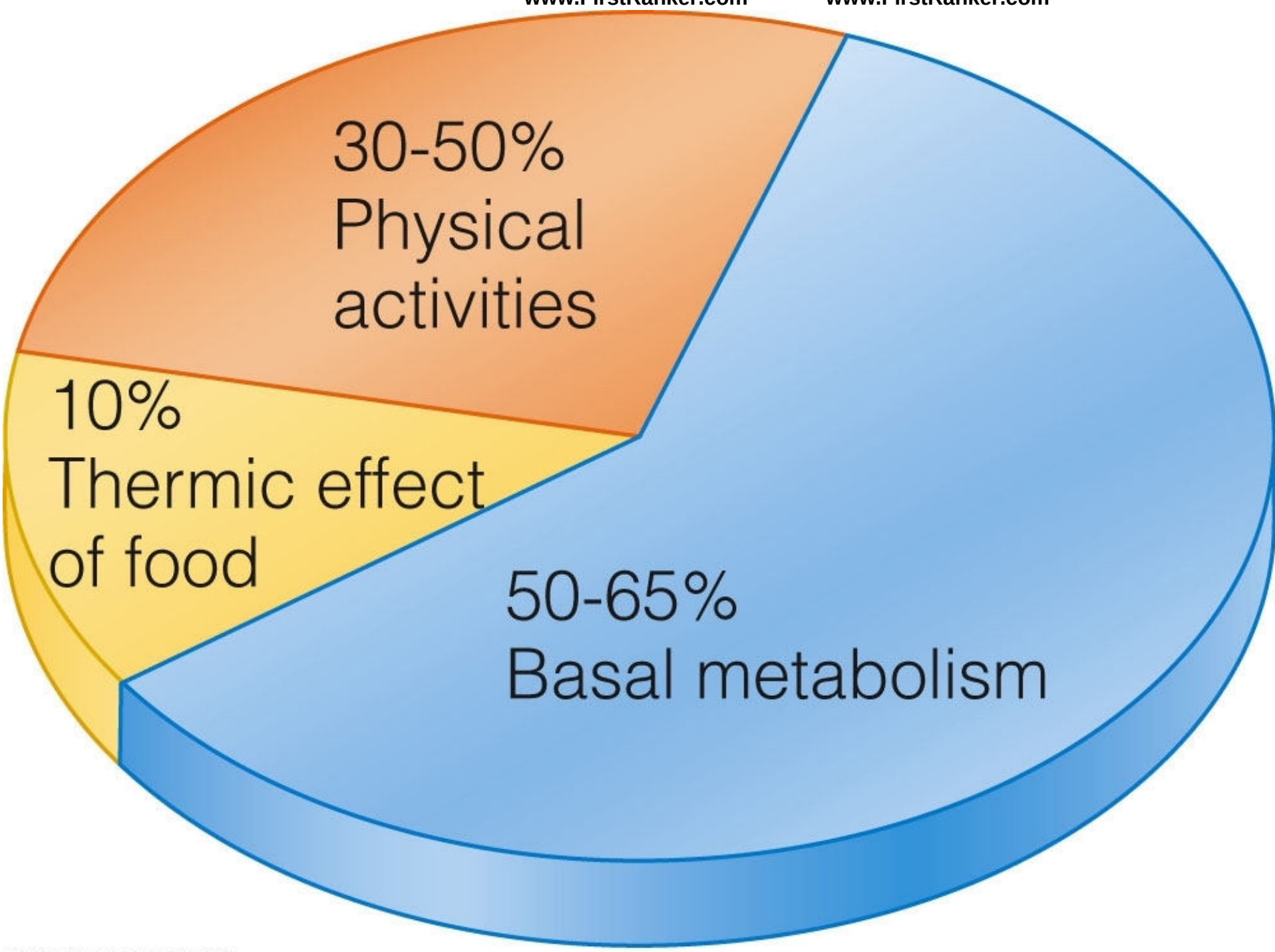
Daily amounts of each food group based on calorie needs

Food Group[a]	1,000 Calories	1,200 Calories	1,400 Calories	1,600 Calories	1,800 Calories	2,000 Calories
Fruits	1 cup	1 cup	1 ½ cups	1 ½ cups	1 ½ cups	2 cups
Vegetables	1 cup	1 ½ cups	1 ½ cups	2 cups	2 ½ cups	2 ½ cups
Grains	3 ounces	4 ounces	5 ounces	5 ounces	6 ounces	6 ounces
Protein foods	2 ounces	3 ounces	4 ounces	5 ounces	5 ounces	5 ½ ounces
Dairy	2 cups	2 ½ cups	2 ½ cups	3 cups	3 cups	3 cups

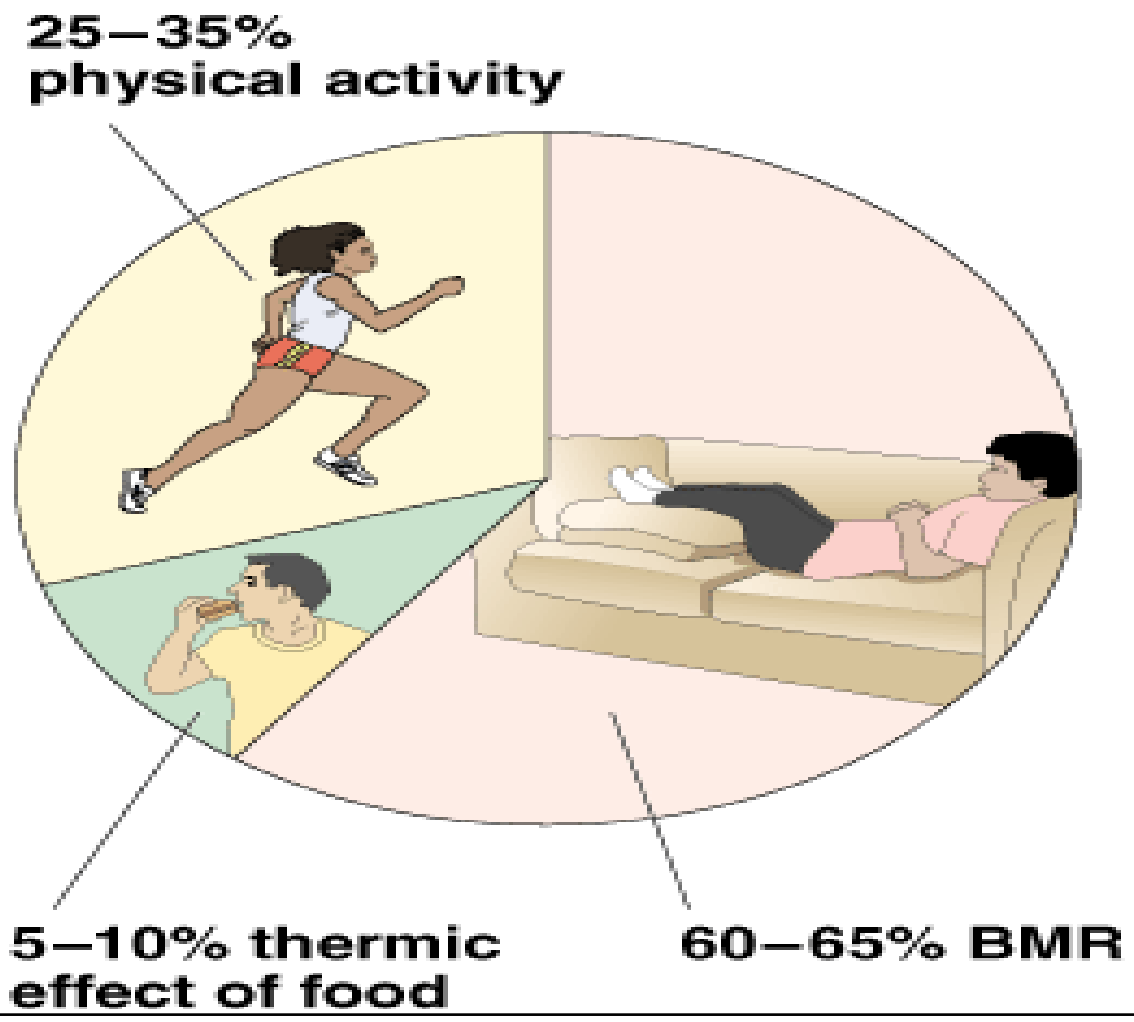
Food Group[a]	2,200 Calories	2,400 Calories	2,600 Calories	2,800 Calories	3,000 Calories	3,2000 Calories
Fruits	2 cups	2 cups	2 cups	2 ½ cups	2 ½ cups	2 ½ cups
Vegetables	3 cups	3 cups	3 ½ cups	3 ½ cups	4 cups	4 cups
Grains	7 ounces	8 ounces	9 ounces	10 ounces	10 ounces	10 ounces
Protein foods	6 ounces	6 ½ ounces	6 ½ ounces	7 ounces	7 ounces	7 ounces
Dairy	3 cups	3 cups	3 cups	3 cups	3 cups	3 cups

An Amount of Energy Needed by a body is Utilized for Following Factors:

1. **Basal Metabolism (BMR)**
2. **Physical Activities**
3. **Specific Dynamic Action of foods(SDA)/ Thermic effect of Food Nutrients**



BMR > Activity > Dietary Thermogenesis



Total energy Requirement

Energy for basal metabolism
1 kC /hr/kg body wt / per day

+

Energy for daily activities
(walking, sitting, standing etc.)

+

Energy for occupational work
(heavy / moderate / sedentary)

Basal Metabolic Rate (BMR)

What Is

- **Basal Metabolic Rate (BMR) ?**

- **BMR is minimum amount of energy required by a** body to maintain life in **basal condition**.

- **Basal condition of body is :**

1) **Post Absorptive Phase**
2) **Awake condition**
3) **Thermo neutral environment**
4) **Complete physical and mental rest**

- **BMR** is **minimum resting energy expended by an individual in an awake, alert , post absorptive phase present in thermoneutral environment.**

- An **energy required in basal condition** is consumed for an **involuntary actions of body viz**
  - **Pumping of Heart**
  - **Blood Circulation**
  - **Respiration process by Lungs**
  - **Muscular Twitching and reflexes**
  - **Intestinal Peristalsis**
  - **Metabolic Reactions**
  - **Renal Functions**

Determination Of BMR

BMR= Total heat production in Cal/hr

Body surface area in Sq.m

Normal Values Of BMR

- Males= 35-40 kcal/ sq.m /hr
- Females= 30-35 kcal/ sq.m /hr

Preparation Of Patient For BMR Estimation

- **In early morning subject should be in:**
  - **Post absorptive phase** (12 hr Fast)
  - **Physically and mentally relaxed**
  - **Lying position, awake condition**
  - **Room Temperature** should be around **21-25 degree centigrade**
  - **Normal humidity**

Methods For BMR Calculation

- **Direct Method For BMR Determination Using :**

–Benedict Roth Apparatus

–Dubois Apparatus

- **Benedict-Roth Apparatus**

- **Calculates an amount of Oxygen consumed** under a specific **basal condition.**

- **Oxygen consumption for 2-6 minutes** and **measure the value from graph.**

- **Indirect Method of BMR Determination:**
  - **Analysis of an expired air**
  - **Determining O2 consumption and CO2 output.**
- **Total heat production is determined** and is then
- **Calculated per sq.m of body surface per hour**

- **Indirect Calorimetry:**

Calculates Respiratory Quotient

- Oxygen Consumption
- Carbon Dioxide Production

- **Spirometer or Respirometer** apparatus is used to **measure an amount of Oxygen consumed and Carbon dioxide produced.**
- This helps in calculating an energy expenditure.

Respiratory Quotient

- **Respiratory Quotient (RQ)** is **ratio of volume of carbon dioxide produced** to **volume of Oxygen consumed** by an individual in a **given interval of time.**

Respiratory Quotient (RQ)

$$RQ = \frac{\text{Volume of } CO_2 \text{ Produced}}{\text{Volume of } O_2 \text{ Consumed}}$$

At the CELL

Each substrate has its own RQ value.

(Carbohydrates (1.0) vs Fatty acids (0.7))

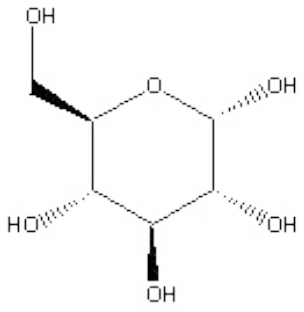
- ***Respiratory Quotient* (RQ)**

  - Amt of CO_2 produced/O_2 consumed
  - **Varies for different Calorific Nutrients**

- **Amount of CO_2 formed does not always equal amount of O_2 consumed**

RQ for CHO and FAT

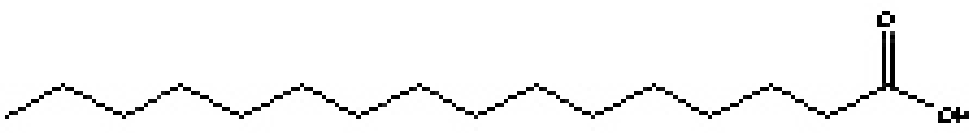
Carbohydrate (Glucose):



$C_6H_{12}O_6 + 6O_2 \rightarrow\rightarrow\rightarrow 6CO_2 + 6H_2O + Energy$

RQ = $6CO_2$ / $6O_2$ = <u>1.00</u>

Fat (Palmitic Acid):



$C_{16}H_{32}O_2 + 23O_2 \rightarrow\rightarrow\rightarrow 16CO_2 + 16H_2O + Energy$

RQ = $16CO_2$ / $23O_2$ = <u>0.70</u>

- **R.Q of Protein is 0.8**

- **R.Q of Mixed diet is 0.85**

- **R.Q in Heavy work exceeds more than 1.**
  - During heavy exercise **tissue metabolism is increased.**
  - **CO_2 out put is increased by enhanced pulmonary ventilation**
  - **Oxygen consumption** is **not proportionately increased.**

- Thus R.Q is an **indicator of metabolic status.**
- **R.Q of food stuffs depend upon:**
  - **Type of food Nutrients**
  - **Their varying proportions**

- **RQ value can be used** to find an **amount energy produced** per litre of Oxygen consumed

- **Conditions increasing R.Q**

- **Violent Exercise**
- **Fever**
- **Acidosis**

- **Conditions Decreasing R.Q**

- **Starvation**
- **Diabetes mellitus**
- **Alkalosis**

Significance Of R.Q

- **R.Q value helps in:**
  - **Estimation of Basal Metabolic Rate**
  - **Type of food oxidized**
  - **Diagnosis of various pathological conditions** such as **Acidosis , Diabetes mellitus ,fever etc.**

- **To estimate Calories needed for basal metabolism/hour**:
  - **For Men**: Multiply body weight (lbs) by 11
  - **For Women:** Multiply body weight (lbs) by 10

Average Calories Required for Basal Metabolism is 70 C/hr or 1680 C/day

Factors Affecting BMR

BMR is Influenced By Many Factors.

- Age
- Sex
- Body Surface Area
- Climate/Environmental Temperature
- Nutritional Status
- Hormones-Insulin Therapy
- Pregnancy
- Physical Activity- Exercises

- Circadian Rhythms
- Emotional State
- Smoking and Caffeine
- Body temperature
- Diseases
- Digestive Processing

(Specific Dynamic Action)

- Aquatic Salinity (Osmoregulation)

BMR and Metabolism

- **High rate of Metabolism Increased BMR**
- **Decreased Metabolism Decreased BMR**

Age

- **Infants and children** have much **higher BMR than adults**.
- **Growth** increases BMR.
- **Highest BMR** is noted at age of **5-6 yrs** (58kcal/sq.m/hr)
- **BMR** is gradually **decreased** as **age proceeds**

Gender/Sex

- BMR of **men is always higher than women**.
  - **Men possess**
    - increased lean muscle mass.
    - increased physical activities.

Body Surface Area

- **Body surface area** is related **to height and weight of an individual.**
- BMR is directly proportional to the **body surface area.**

- Increased Body Surface **(lean muscle)** area has greater BMR.

- **Lean muscle mass is more metabolically demanding than Fatty tissue(Adipose cytes).**

- **Lean tall p**ersons with **greater muscle** mass has **higher BMR.**

- **Obese short** persons with **lower lean muscle** mass has **lower BMR**.

- **Lower body Fat** percentage **higher is the BMR**.

- **Higher body Fat** percentage **lower is the BMR**.

Climate/Environment Temperature

- BMR is decreased in **summer**
- BMR is increased in **winters**
- People living in **warmer climates has lower BMR than living in colder climates**

Nutrition and Metabolic Status

- **BMR is lower** in persons with **malnutrition and starvation.**

Endocrine Secretion/Hormones

- **Thyroid hormone influences directly on BMR**
  - **BMR is increased** in **Hyperthyroidism**
  - **BMR is decreased** in **Hypothyroidism.**

- High levels of **Growth hormone and Epinephrine** also **increases BMR**.

- **BMR lower in Diabetes mellitus**

- On **Insulin therapy BMR is increased**

Pregnancy

- **BMR is raised by 5% in pregnancy.**

BMR And Physical Activity

ACTIVITY LEVEL	PERCENTAGE OF BASAL METABOLISM CALORIES
Inactive: sitting most of the day; <2 hours moving about slowly or standing	30%
Moderate: sitting most of the day; walking or standing 2-4 hours, no strenuous activity	50%
Active: physically active for >4 hours a day; little sitting or standing; some strenuous activity	75%

Categorization of workers

Light worker	Moderate worker	Hard worker
Office worker	Railway worker	Coal miner
Driver	Postman	Steel worker
Shopkeeper	Plumber	Army recruit
Teacher	Bus conductor	Docker
Lawyer	Tailor	Labourer
Doctor	Carpenter	

Factors affecting Energy Requirement

- Age
- Sex
- Working Condition
- Body Composition
- Physical Activity
- Vulnerable / At Risk Groups
  1. Pregnant & Lactating mothers
  2. Infants & Children
  3. Elderly

Thus BMR Increases With Rate Of Physical Activity

Circadian Rhythms

- BMR is **lower in sleep**
- BMR is **higher in awake**

Emotional State

- **Stress** increases BMR

Smoking and Caffeine

- **Smoking and ingestion of Caffeine increases BMR.**

Body Temperature

- BMR increases with increasing **body temperature**.
- An elevation of body temperature above 37^0C will increase BMR by 13% per ^{0}C.
- **Thus in Fever BMR is raised.**

BMR In Diseased Conditions

- **BMR is Increased in**

- **Fevers**
- **Leukemia**
- **Cardiac Failure**
- **Hypertension**
- **Metabolic disorders**
- **Surgery**
- **Infections**
- **Anorexia**

Factors Affecting BMR

List Of Conditions Increasing And Decreasing BMR

S.No	BMR Increased High Metabolism	BMR Decreased Low Metabolism
1	At Growing Age	Infant and Geriatric
2	Active Body	Sedentary Body
3	Exercise	No Exercise
4	Males	Females
5	Winters	Summers
6	Hyperthyroidism	Hypothyroidism
7	More Body Surface Area	Low Body Surface area

S. No	BMR Increased	BMR Decreased
8	Pregnancy	No Pregnant Women
9	Fevers	Malnutrition
10	After Surgeries	Starvation
11	Lean Body	Obese body
12	Smoking	Non Smoker
13	Day and Night Workers	Only Day workers
14	Insulin Therapy	Diabetes Mellitus
15	Stress	No Stress

CALCULATE
BASAL METABOLIC RATE

Calculat Your BMR

WOMEN:

655 + (4.35 x weight in pounds) + (4.7 x height in inches) - (4.7 x age in years)

MEN:

66 + (6.23 x weight in pounds) + (12.7 x height in inches) - (6.8 x age in years)

Significance Of BMR Calculation

- BMR values help in **calculating energy requirement** of an individual body which help in **planning of diets.**

- To know an **effect of food and drugs** on BMR.

- BMR value **checks basal metabolism** and **disease conditions**.

- BMR values help in **assessing Thyroid function.**

Energy Required For Physical Activities

- **Energy requirement** for an individual per day **varies from:**
  - ❖**Person to Person**
  - ❖**Mode of life style**
  - ❖**Type of Occupation**
    - **Action to Action**
      - –**Duration of Action**
      - –**Intensity of Action**

Energy Requiring Factors For Physical Activities

- Age
- Sex
- Body Surface Area –
  - **Body weight ,Size and Height**

Workers	Calories/Day	B.M.R %
Light Workers Teachers, Doctors, Office Workers	2200-2500	30-40%
Moderate Workers Students, House wives	2500-3000	40-50%
Heavy Workers Farmers ,Miners, Athlete	3000-3500	50-60%
Very Heavy Workers Rickshaw Pullers, Construction Workers	3500-4000	60-100%

Activity	Energy Expenditure in Calories/ hour
Sitting	25 Calories/hour
Standing	30 Calories/hour
Writing	30 Calories/hour
Car Driving	**60 Calories/hour**
Typing	75 Calories/hour
Walking Upstairs	800 Calories/hour

Every **physical activity** needs energy above BMR

Energy Cost of Physical Activities

Activity	*Cal/KgBW/Hour*
Bicycling (fast)	**7,6**
Bicycling (slow)	**2,5**
Dancing (foxtrot)	**3,8**
Dancing (waltz)	**3,0**
Dish washing	**1,0**
Driving	**0,9**
Table tennis	**4,4**
Marathon run	**7,0**
Sawying	**5,7**
Walking 5 km/h	**2,0**
Writing	**0,4**
Playing piano	**2,0**
Sewing	**0,6**

Specific Dynamic Action (SDA)

Thermogenic Effect Of Food (TEF)

Diet Induced Thermogenesis (DIT)

SDA also termed as

Calorigenic Action Of Food

Specific Dynamic Action (SDA)

- Thermic effect of food (abbreviated as TEF), also known as specific dynamic action (SDA) of a food or dietary induced thermogenesis (DIT), is the amount of energy expenditure above the resting metabolic rate due to the cost of processing food for use and storage.

Specific Dynamic Action (SDA):

Specific Dynamic Action (SDA):

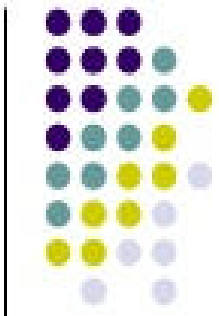
- The food processing charge.
- Also called the thermic effect of food.
- ~10% of the total number of Calories consumed is required for the digestion, absorption & assimilation of nutrients into the body.
  - **Metabolism is increased when fed**

Specific Dynamic Action of Food

- Is the term used to describe the expenditure of calories during the digestion and absorption of food.
- Studies have shown that the heat increment, or thermogenic response, necessary to digest and absorb fat is 2%, for carbohydrate is 6%, and for protein-rich foods is about 12%.
- In general, the specific dynamic effect of diet is calculated to contribute approximately 10% of the consumed calories.

- **SPECIFIC DYNAMIC ACTION(SDA)**
- **i. This refers to the increased heat production** or increased metabolic rate following the intake of food **(thermogenic effect of food) (dietinduced thermogenesis).**
- **ii. Part of this is due to the expenditure of energy** for digestion; absorption and active transport of products of the digestion.
- **iii. Another reason** for this expenditure of energy is that reserve materials such as glycogen, triacyl glycerol, protein, etc. are synthesized from small molecules available after digestion.
- Iv. SDA can be considered as the
- activation energy needed for a chemical
- reaction. This activation energy is to be
- supplied initially.

Specific Dynamic Action (SDA):
(Thermogenic effect of food)
(Diet induced thermogenesis)



- Increased heat production (metabolic rate) following intake of food
- It is due to energy expenditure for
  1) digestion and absorption of nutrients
  2) synthesis of glycogen, TAG, proteins (energy reserves)

- **SDA** is an **extra heat produced over and above calculated calorific value when food nutrients** consumed by a body.

- **SDA is referred as an increased heat production following an intake of food.**

Dietary Proteins Has Highest SDA Values

- **25 gm of dietary proteins** when consumed in body should produce 100 Calories of energy.
- **25 x 4= 100 Calories**
- But actual heat produced is **130 Calories**
- **Thus 30 Calories of energy is extra**.

Mechanism of SDA

- SDA of foods is due to the energy required for digestion, absorption, transport, metabolism and storage of foods in the body.
- The SDA of proteins is primarily to meet the energy requirements for deamination, synthesis of urea, biosynthesis of proteins, synthesis of triacylglycerol (from carbon skeleton of amino acids).

Specific Dynamic Action (SDA)

1. What is SDA?
2. Is there any difference between SDA, thermogenic effect of food, and diet-induced thermogenesis ?

- **What is SDA of foods?**
  - 100 calories of white sugar → SDA 7%
  - 100 calories of butter/oil → SDA 12%
  - 100 calories of protein → SDA 30%

Increasing order!

SPECIFIC DYNAMIC ACTION (THERMIC EFFECT OF FOOD)

- **Specific dynamic effect of food** – estimated energy used in digestion and absorption of food.
- **Diet induced thermogenesis** is ↑ energy due to ↑ in metabolic rate due to overeating
  - CHO 5-10%
  - Fat 0-5%,
  - Protein 20-30%
  - Alcohol 20%

- **Protein rich meal** eaten in **hot weather** feels the body **hot and sweaty**.

- Protein rich meal in **cold weather** provide **cozy and comfortable feeling**.

Significance Of SDA

- **Heat of SDA** can be utilized for **maintaining body temperature** but **not for muscular activity.**

- SDA produced **heat is expended for digestion and absorption** of food.

Conditions with Decreased SDA

- Conditions where **amino acid catabolism decreased**
- **SDA is decreased**
  - **Starvation**
  - **Growth**
  - **Pregnancy**
  - **Convalescence period** (Recovery)

SDA of food is an amount of energy required to digest mixed food (Carbohydrate, protein, lipid, fruit & vegetable).

Approximately 10% of BMR is required as SDA of food

Adult 60 Kg, requires BMR =24 Cal/kg

BMR = 1440 Cal
SDA = 144 Cal
Total = 1584 Cal (BMR+SDA)

Total Daily Energy Requirement

- TDR = BMR + EEA + SDA
  TDR = total daily requirements
  BMR = basal metabolic rate
  EEA = energy expenditure of activity
  SDA = specific dynamic action of food

Balanced Diet

OR

Prudent Diet

(Wise, Well Judged,Judicious,Well Advised)

(Thoughtful, Careful, Right Way Of Eating)

- **Human body if considered as a Machine**
  - **–Food is our fuel**

- **Maintaining General health and well being of human body is first priority**

- **Nutrition** is a **first need of human beings to acquire good health.**

- **Health and Unhealth of body directly depends upon**

- **Nutritional status of an individual**

What and How We Build Our Body Depends On What We Eat ???

Food Nutrients Determines:

- Bodies composition and built of cells/Organs/Systems
- Bodies capacity to grow, repair and reproduce
- Bodies strength to cope up with:
  - Interacting environmental pollutants
  - Multi tasking ability
  - Routine Stress

What Is a Balanced Diet?

How Truly We Plan for Our Eating?

Let Us Think for a Moment

Do We??????

Yes /No????????

We Plan and Implement

- **Comparatively More**
  - –Trips
  - –Fests
  - –Parties
  - –Games
- **Comparatively Less**
  - –Career
  - –Academics
  - –Exams

Lets Us Well Plan Our Diet

And Implement

For Eating Our Food

For

HEALTH ,HAPPINESS, PEACE AND SUCCESS

Balanced Diet
Planned Diet
at Various Physiological States

Balanced Diet A Healthy Diet

Features of Balanced Diet

- **Balanced diet provides the mixture** of **all dietary nutrients in:**
  - **Adequate quantity**
    (Restrict to RDA values)
  - **Good quality**

- **Balanced Diet Provides**

–**Calorific needs**

–**Building blocks**

–**Accessory Growth factors**

- Balanced diet **does not allow an individual**
- **To ingest any one dietary nutrient in excess or less amount.**

- **Thus Balanced diet prevents a body**

- **To suffer from over or under nutritional disorders.**

- It is **especially important** to **take care of eating during**
  - **Growth, Pregnancy and lactation**
  - **Remember a young plant, not given proper nutrients grows up to a poor specimen with less/no fruits and flowers.**

Right Diet will
Build Human Body Systems Strongly
And Protect Our Gene Functions

- **Withstand Stress** to carry out **multi tasking activities**
- **Prevent from** almost all diseases of any system
  - –Infection , Immune Disorders
  - –Depression
  - –Genetic Disorders
  - –Metabolic Disorders
  - –Hormonal Disorders
  - –Anemia

Points To Consider
While Planning For Balanced Diet

1. Physiological States
2. BMR (Considering all factors)
3. Physical activities of an individual
4. SDA

- Food included during planning of balanced **diet should be locally available**

- Food should be **within economic means of people.**

- It should **fit with local food habits.**

- Balanced diet food items should be **easily digestible and palatable.**

- Food eaten should **contain all the chief essential nutrients** which **suffice bodies health, growth and reproduction.**

- An individual **should eat following food groups in recommended quantity and quality** and maintain balanced diet.
  - **Cereals and Pulses**
  - **Milk**
  - **Meat and Fish**
  - **Vegetables and Fruits**

- **RDA values differ** during **different physiological states** of human body
- viz growth, pregnancy, lactation and convalescence.

Points To Remember

- During **growth, pregnancy and Lactation dietary intake should be increased**

- To develop fetal growth **and maintain reproduction**

Indian Balanced Diet

- **Nutrition Expert Group constituted by ICMR**
- Taking into **account of Indian available foods**
- Has **recommended composition of Balanced diets for Indians.**

Indian balanced diet composed of

- Cereals : Rice, Wheat,Jawar
- Pulses
- Vegetables- Roots,Tubers
- Fruits
- Milk and Milk products
- Oil
- Sugar
- Fish
- Meat
- Eggs

Recommended Daily Allowance(RDA)

- RDA of Chief Nutrients for an Adult Individual
- Prescribed by WHO
- Modified by ICMR as per Indian conditions

Nutrient	RDA in Grams
Carbohydrates	400 gm
Fats	70 gm
Proteins	60 gm
Fiber	40 gm

- **Carbohydrate content of Some common foods**

Food Item	Carbohydrate Content
Cane Sugar	100 %
Rice	80%
Wheat	70-80%
Bread	50-60%
Potatoes	25%

Vitamins	RDA
Vitamin A	3000- 4000 IU
Vitamin D	200-400 IU
Vitamin E	9 mg
Vitamin K	70 ug
Vitamin C	60 mg
Folate	400 ug
Thiamine (B1)	1.2 mg

Vitamins	RDA
Biotin	30 mcg
Riboflavin (B2)	1.2 mg
Niacin (B3)	15mg
Pantothenic (B5)	5 mg
Pyridoxine (B6)	1.6 mg
Cyanocobalamin (B12)	2.4 ug

Minerals	RDA
Calcium (Ca)	1200 mg
Phosphorus (P)	700 mg
Magnesium (Mg)	370 mg
Sodium (Na)	500 mg
Chloride (Cl)	750 mg
Potassium (K)	2000 mg

Minerals	RDA
Iodine (I)	150 ug
Iron (Fe)	10 mg
Copper (Cu)	1.5 mg
Zinc (Zn)	14 mg
Selenium (Se)	60 ug

Minerals	RDA
Molybdenum (Mo)	75 ug
Manganese (Mn)	2 mg
Fluoride (F)	4 mg
Chromium (Cr)	50 ug

RDA (per day) for Indians (ICMR)

Group	Particulars	Body Wt. kg	Net Energy kC	Protein gm	Fat gm	Ca mg	Fe mg
Man	Sedentary	60	2425	60	20	400	28
	Moderate	"	2875	"	"	"	"
	Heavy work	"	3800	"	"	"	"
Woman	Sedentary	50	1875	50	"	"	30
	Moderate	"	2225	"	"	"	"
	Heavy work	"	2925	"	"	"	"
	Pregnancy	"	+300	+15	30	1000	38
	Lactation (0-6 m)	"	+550	+25	45	"	30
	Lactation (6-12 m)	"	+400	+18	"	"	"

RDA (per day) for Indians (ICMR)

Particulars	Retinol mcg	Beta Carotene mcg	Thiamin mg	Ribo-flavin mg	Niacin mg	Vit. C mcg	Folic Acid mcg	Vit. B 12 mcg
Sed.	600	2400	1.2	1.4	16	40	100	1
Mod.	"	"	1.4	1.6	18	"	"	"
Heavy	"	"	1.6	1.9	21	"	"	"
Sed.	"	"	0.9	1.1	12	"	"	"
Mod.	"	"	1.1	1.3	14	"	"	"
Heavy	"	"	1.2	1.5	16	"	"	"
Preg.	"	"	+0.2	+0.2	+2	"	400	"
Lact. 0-6 m	950	3800	+0.3	+0.3	+4	80	150	1.5
Lact. 6-12 m	"	"	+0.2	+0.2	+3	"	"	"

RDA (per day) for Indians (ICMR)

Age	Body Wt. kg	Net Energy kC	Protein gm	Fat gm	Ca mg	Fe mg
0-6 m	5.4	108/kg	2 g/kg	-	500	-
6-12 m	8.6	98/kg	1.6g/kg	-	"	-
1-3 yr	12.2	1240	22	25	400	12
4-6 yr	19.0	1690	30	"	"	18
7 9 yr	26.9	1950	41	"	"	26

Recommended Dietary Allowances for Calcium and Vitamin D

Age	Amount of Calcium Per Day	Amount of Vitamin D Per Day
0 to 6 months	200 mg	400 IU
7 to 12 months	260 mg	400 IU
1 to 3 years	700 mg	600 IU
4 to 8 years	1000 mg	600 IU
9 to 18 years	1300 mg	600 IU

Dietary Reference Intakes for Water

Age Group	Gender	Adequate Intake*
1-3 years	Males and females	1.3 liters ~5.5 cups/day
4-8 years	Males and females	1.7 liters ~7 cups/day
9-13 years	Males	2.4 liters ~10 cups/day
	Females	2.1 liters ~9 cups/day
14-18 years	Males	3.3 liters ~14 cups/day
	Females	2.3 liters ~10 cups/day
≥ 19 years	Males	3.7 liters ~15.5 cups/day
	Females	2.7 liters ~11 cups/day
Pregnancy 14-50 years	Females	3.0 liters ~12.5 cups/day
Lactation 14-50 years	Females	3.8 liters ~16 cups/day

Uses of RDA

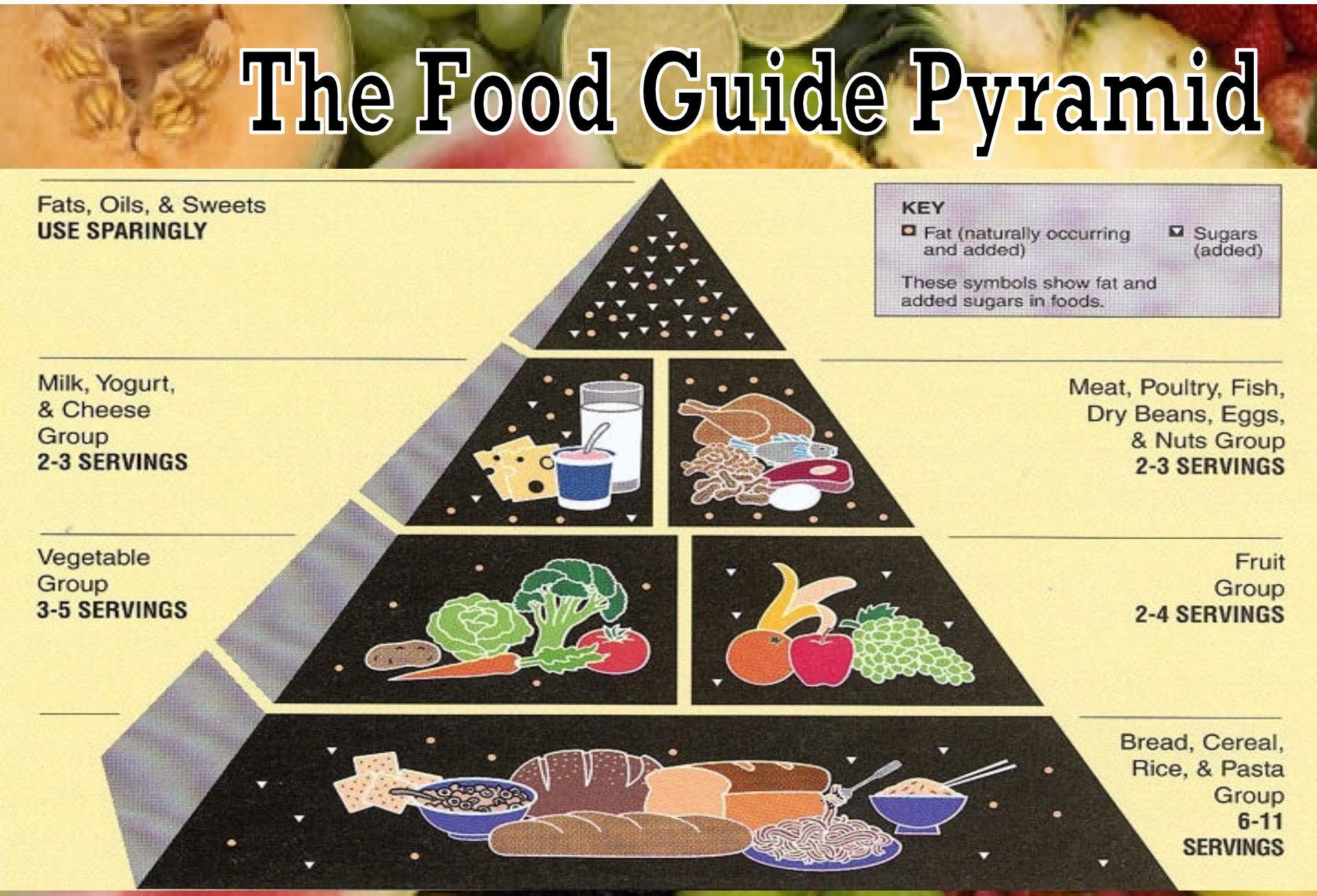
- Basis for all feeding program (school lunch program)
- To interpret food consumption record
- To understand nutritional needs
- Guidelines for public food program
- To develop and evaluate the new food product
- To develops the nutritional education program

Maintain Balanced Diet By

- Eating items from **all food groups**

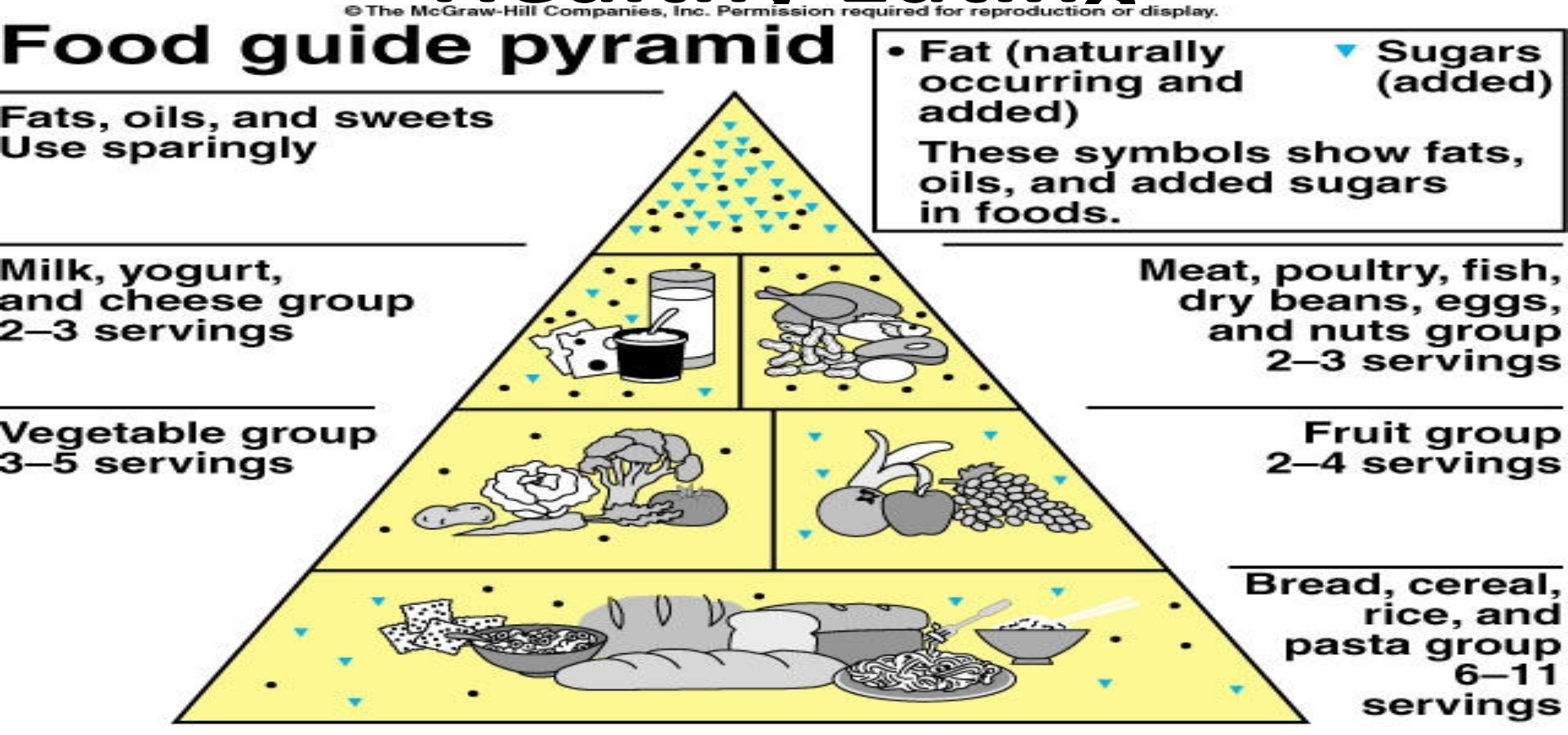
- With **appropriate quantity and good quality** to provide all nutritionally essential nutrients.

- **Eating properly and regularly (Timely) without skipping the whole meals.**



Eat A Balanced Diet

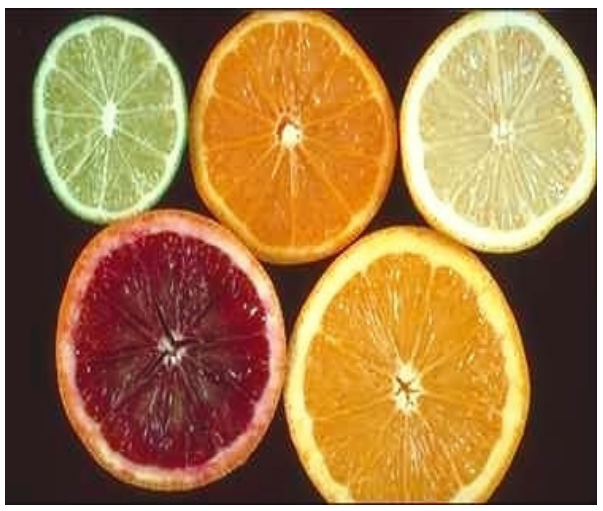
Guidelines for Healthy Eating



Follow principles in the Food Guide Pyramid

- **75% of a day's food**
- Should come from **grains, vegetables and fruits**

- Extra servings of green and yellow vegetables may be beneficial



- Extra **consumption of citrus and other fruits may be beneficial**

- Its necessary to maintain **balanced diet since:**

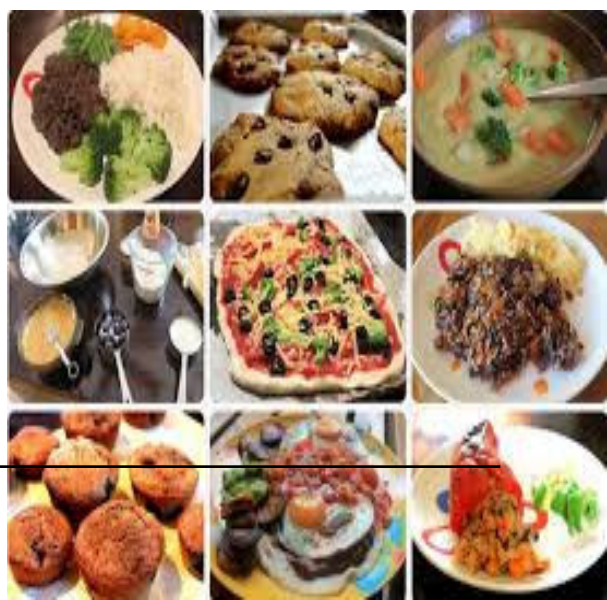
- What we **eat today,** will affect our **health in future.**

Tips For Eating Well

Know And Implement

Do’s and Don'ts of Eating

Eat More Natural and Home Made Food



- Eat **regular meals**
- **Do not skip breakfast**
- Eat foods **from all food groups** /According to **food pyramid**
- **Limit processed /Junk food**

- Prefer **meals on starchy foods**
- Eat **Egg and Fish**
- Eat **adequate amounts of vitamins and minerals**
- Eat **lots of fruit and vegetables**

- **Eat fresh and natural foods**
- **Cut down saturated fats , trans fats and refined sugars.**
- Try to **eat less salt** (no more than 5g/day)
- **Say No to Alcohol**
- **Limit Tea and coffee**
- **Drink plenty of clean water**
- **Maintain a healthy weight**.
- **Keep body active- Work/Exercise**

Regularly Recall the 8 tips





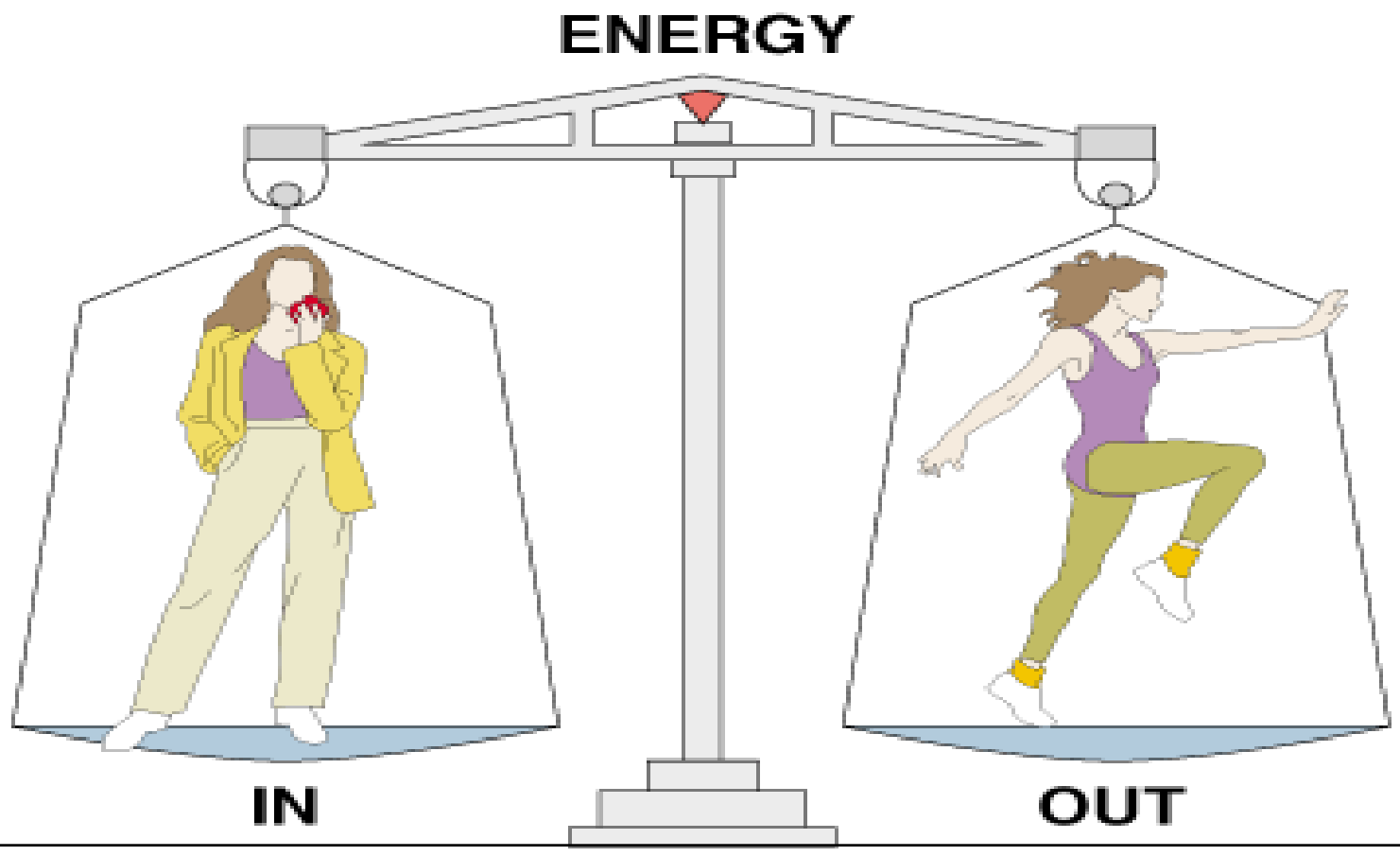



Energy Balance and Imbalance

- **Body weight is stable** when **energy consumed is equal to energy expended.**
- This is termed as **Nitrogen balance**.

Energy Balance:

Input vs Output



One pound of body weight is equal to 3,500 kilocalories

- **Body weight increases**, when **energy consumed is greater than energy expended.**

- **Body weight decreases** when **energy consumed is less than it expenditure.**

- **Balanced Energy Intake**: not losing or gaining weight
- **Negative Energy Balance**
  - Weight loss: Energy intake < Energy expended
- **Positive Energy Balance**
  - Weight gain: Energy intake > Energy expended

Significance Of Balanced Diet

Balanced Diet Makes Life Healthy And Happy

- Eating balanced diet right from the **beginning of life builds:**
- **Organ system of human body with full of strength and vital capacity**
- This prepares **body to face any critical conditions.**
  - **Metabolic stress**
  - **Infections** etc

- **Balanced diet Significantly**
- Maintains bodies **normal growth , health and reproduction.**
- **Prevents** from **suffering of nutritional disorders.**
- **Increases span of healthy and happy life.**

Nutritional Disorders

Result/Outcome/Punishment

Due to Extreme Imbalanced/Uncontrolled Ingestion Of Nutrients

(Ignorance,Negligence,Nonimplementation, Disobedience)

Do Reflection Analysis of Dietary Habits

MALNUTRITION/ DEFECTIVE NUTRITION

- A **pathological/diseased state** resulting from

- **Relative or absolute deficiency or excess of one or more essential nutrients.**

Forms of Malnutrition

- **Undernutrition:**
  Kwashiorkor, Marasmus
  Specific Deficiency:
  Hypovitaminoses, Mineral Deficiencies
- **Overnutrition:**
  Obesity, Metabolic Syndrome
  Specific Toxicities: Hypovitaminoses

- **Imbalances:** Electrolyte Imbalance

Why Human beings suffer from Nutritional Disorders?

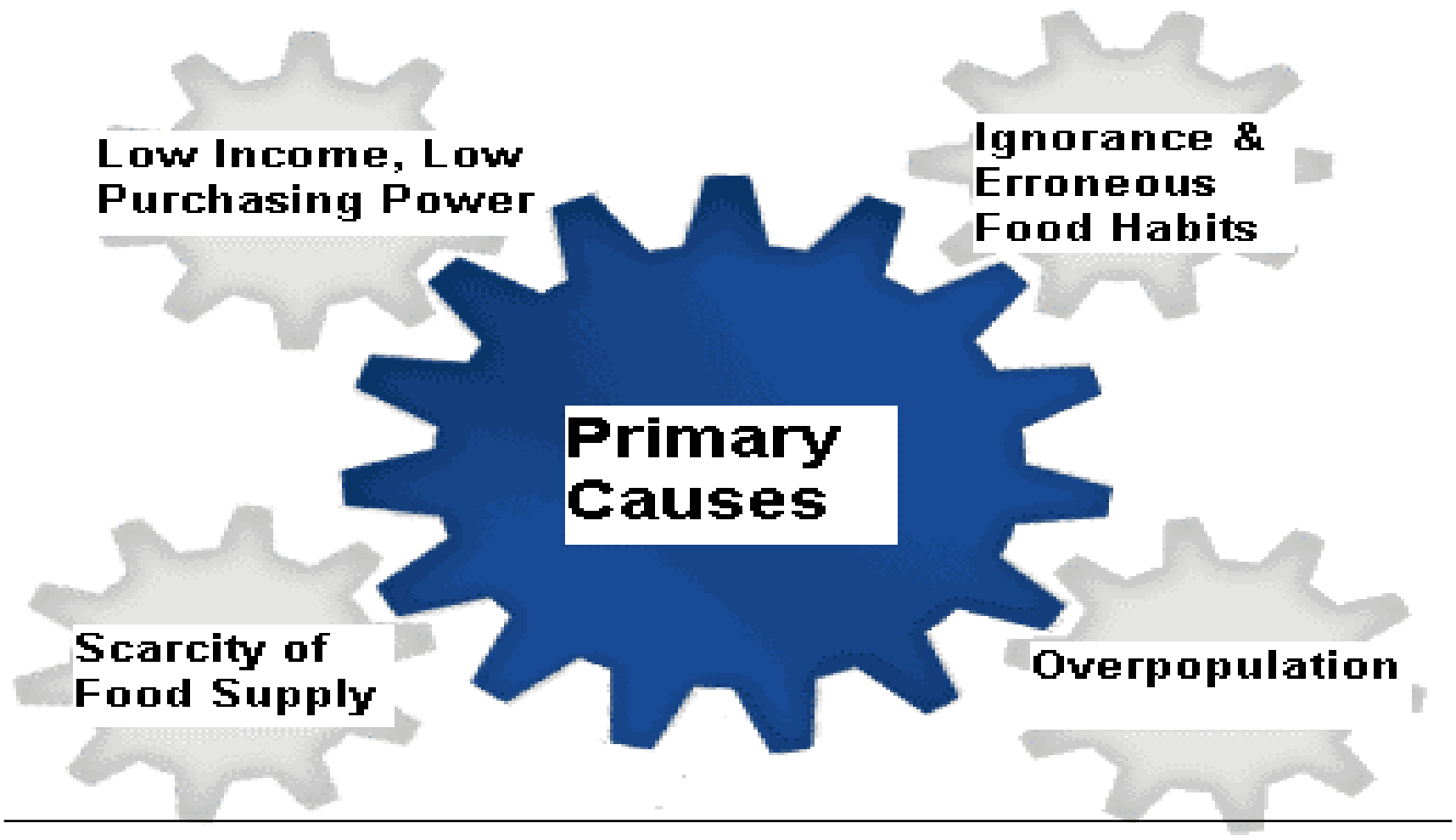
Due to What Factors ?

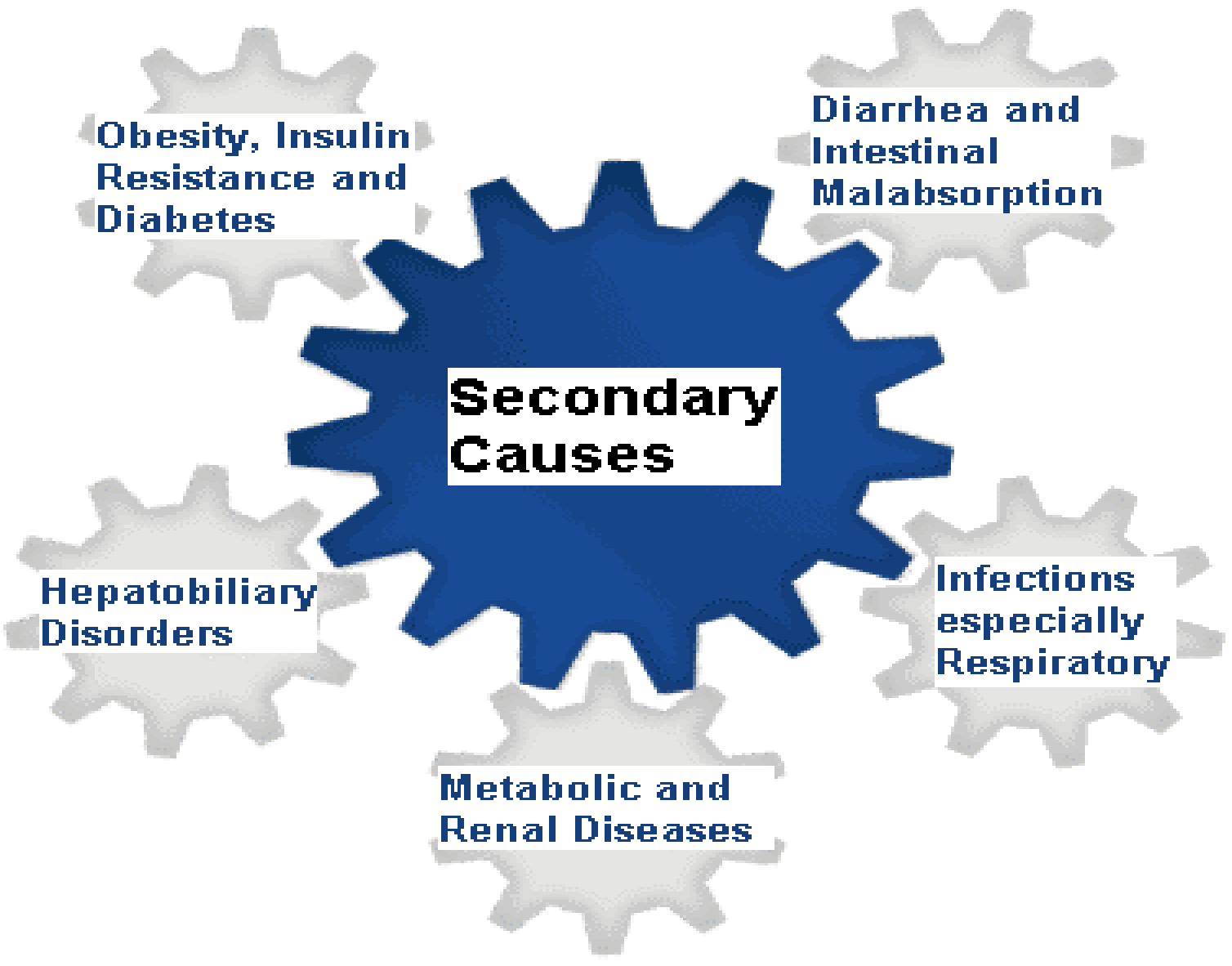
Do Reflection Analysis

- No Planning and Implementing in of Eating
  (Thoughtful and Righteous way)
- Do's and Don'ts of Food Habits
  - Ignorance/Illiteracy
  - Lack of general awareness
  - Negligence
  - Disobedience
- Economical Status-
  - Low and High
  - No proper distribution
- No Regularity and Control on Diet habits
  - Wrong food habits
  - No Control/Regulation on eating habits
  - No Change (quit/adopt) for Good Cause
- Results in Nutritional Disorders

- **Availability of food is not uniform due to:**
  - Unequal distribution of food items
  - Unequal economical status of human population
  - No proper planning in Occupations
    - Undefined Number of
      - Farmers/Food Growers and Distributors
      - Doctors
      - Teachers
      - Engineers
      - Other Miscellaneous Professions

ETIOLOGY OF MALNUTRITION





Types Of Nutritional Disorders

- Under Nutritional Disorders
- Over Nutritional Disorders

Under Nutritional Disorders

Under Nutritional Disorders

- It is a **type of Malnutrition**.
- **Less intake** of food nutrients.
- **Insufficient building blocks** and vital growth factors.
- **Insufficient energy sources**.

Unhealthy GIT Affects Absorption Of Nutrients Leads To Nutritional Deficient Disorders

Chronic Use of Chemicals, Alcohol, Drugs Trauma and Infections Lead To Ill-health Of GIT

Protein Energy Malnutrition(PEM)/ Protein Calorie Malnutrition (PCM)

- **Protein Energy Malnutrition (PEM)**

- **Protein and Energy (Carbs and Lipids) deficiency go hand in hand.**

- This combination leads to **protein-energy malnutrition**

- PEM is **worlds most widespread malnutrition problem in developing countries**.

PEM PRECIPITATING FACTORS

- **LACK OF FOOD (Famine, Poverty)**
- **INADEQUATE BREAST FEEDING**
- **WRONG CONCEPTS ABOUT NUTRITION**
- **DIARRHOEA & MALABSORPTION**
- **INFECTIONS (Worms, Measles, T.B)**

PEM
EPIDEMIOLOGY & ETIOLOGY

- Seen most **commonly in the first year of life due to lack of breast feeding and the use of dilute animal milk.**
- **Poverty or famine and diarrhoea are the usual precipitating factors**
- **Ignorance & poor maternal nutrition are also contributory factor**

Development Of PEM

- **Majority of world's** children live in **developing countries**
- Lack of food & clean water, poor sanitation, infection & social unrest lead to **LBW & PEM**

- **PEM leads to**
- **Increased Rates of Infant Mortality**

- **PEM** disorders caused **due to lack of adequate Proteins and Energy in the diet.**

- According to **W.H.O** **PEM is most important public health problem prevailing in developing countries**.

- **PEM most common in Africa, Central America, South America, Middle East, SE/E Asia**
- Also see in US
  - **Homeless**
  - **Inner-city**
  - **Rural poverty**

- **PEM most often affects children:**
  - **500 million children** are malnourished
  - >50% of deaths of <5 children (5 million/year)

- **Adults may also be affected with PEM**
  - Men at greatest risk are:
    - Those living in poverty
    - Elderly living alone
    - Addicted person
    - Eating-disorders
    - Long-term illness

Forms Of PEM

- **Protein Energy Malnutrition (PEM) includes**

  - Kwashiorkor
  - Marasmus
  - Marasmic Kwashiorkar

(Noted during Starvation or Wasting extreme energy deprivation)

»Kwashiorkor

»Marasmus

- **Two Facets of PEM**

PEM Forms Kwashiorkor and Marasmus Illustrates

Two Faces Of Same Coin

Obverse **Reverse**

Kwashiorkor

Risk of Development

- Kwashiorkor means sickness of **displaced/deposed /replaced child**

- **It affects when a first born child, is replaced by a second born child.**

- **Kwashiorkar** describe **sickness of weaning.**
- **Weaning- Process of withdrawl of mothers milk and replace with adult diet**

KWASHIORKOR Historical Aspects

- **Word Kwashiorkor was introduced in medical literature(1933),by Cecilly Williams**, a **British Nurse**.
- **Kwashiorkor is Ghanaian name** for an **Evil Spirit**

Biochemical Cause

- **Kwashiorkar** is an **extreme condition of Protein Energy Malnutrition**
- **Caused due to ingestion of Protein deficient diet.**

Features of Kwashiorkor

- **Age of onset- 1 to 5 years**
- Child gets **displaced by mothers attention.**
- **Ingestion of low dietary Proteins**
- **Weaning protocol not followed**
- **No milk fed instead low protein diet like gruel prepared from grains and potatoes is fed.**

Biochemical Alterations

- **Amino acid deficiency** for tissue protein biosynthesis.
- **Serum Albumin levels markedly decreased < 2gm%**
- **Digestive Enzymes lowered**
- **Overall body Proteins are lowered**
- **Serum Cortisol levels decreased**

Clinical Signs And Symptoms

- **Enlarged abdomen**
- **Pitting edema** of trunk, limbs and eyelids **(Low serum Albumin)**
- **Moon Face**
- **Anemia**
- **Growth retardation**
- **Loss of weight, lethargic**
- **PSYCHOMOTOR CHANGES**
- **SKIN DEPIGMENTATION**

- **Failure of digestion and absorption due to lack of digestive enzymes.**

- **Due to indigestion of food**
  - ❖**Loss of appetite and anorexia**
  - ❖**Diarrhea**
  - ❖**Water and Electrolyte imbalance**

- **Subnormal Immunocompetence (Low Immunity)**
- **Mental Changes observed-Low Neurotransmitters**
- **Fatty Liver-Low/No mobilization of Lipids**
- **Sparse ,soft, thin and curly hairs**
- **Glossitis**
- **Conjunctivitis**

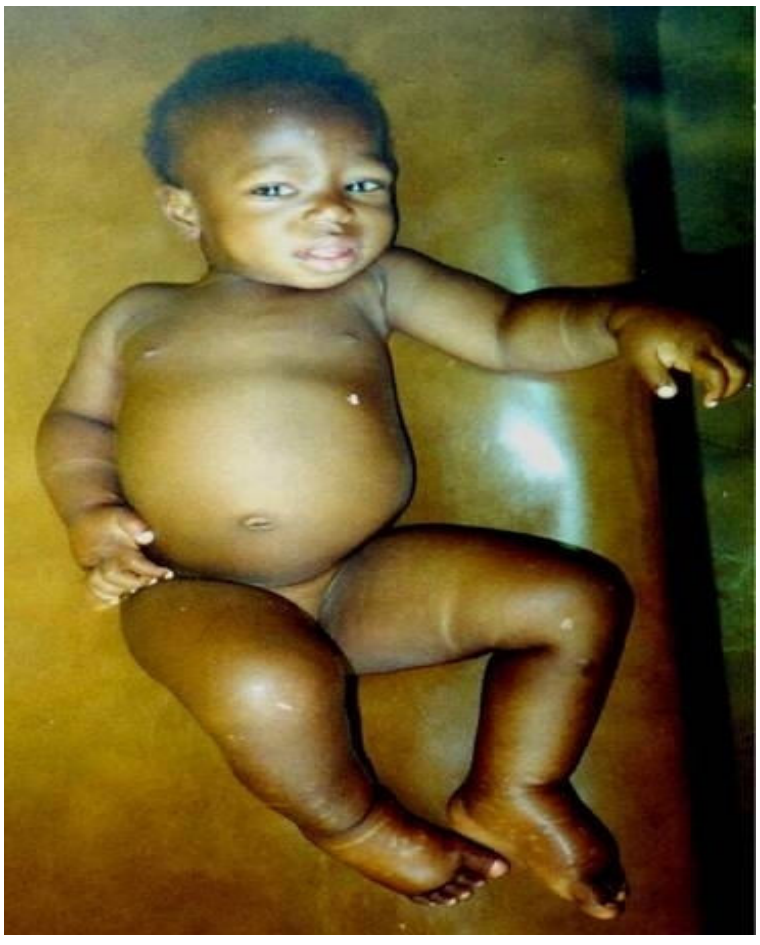
- **One theory says Kwashiorkar** is a result of **Liver insult** with **hypoproteinemia and oedema**.

- **Food toxins** like **Aflatoxin** have been suggested as **precipitating factors for Kwashiorkar.**

Kwashiorkor
(Edematous Malnutrition)

- **Underweight with Edema**
- **Stunted growth**
- **Irritable, difficult to feed**
- **Highest mortality –**

  50 to 60%



Treatment Of Kwashiorkar

- **Gradual feeding with good quality food proteins**
  - **Milk**
  - **Egg**
  - **Legumes /Pulses**

Marasmus

- **Marasmus** means **neglected child**
- Marasmus is a **disorder of PEM** where an **infant is virtually starving**
- Due to **lack of both dietary calories and proteins.**

- Term **Marasmus** is derived from the **Greek** word, **which means wasting.**
- Marasmus involves an inadequate **intake of Protein and Calories and is characterized by emaciation.**
- **Marasmus represents** the **end result of starvation** where **both proteins and calories are deficient.**

Causes Of Marasmus

- Age of onset- **Below 1 year**
- **Deficiency of both Calories and Proteins.**
- Marasmus occurs in areas where there is **severe starvation and famine/draught conditions**.

Biochemical Alterations In Marasmus

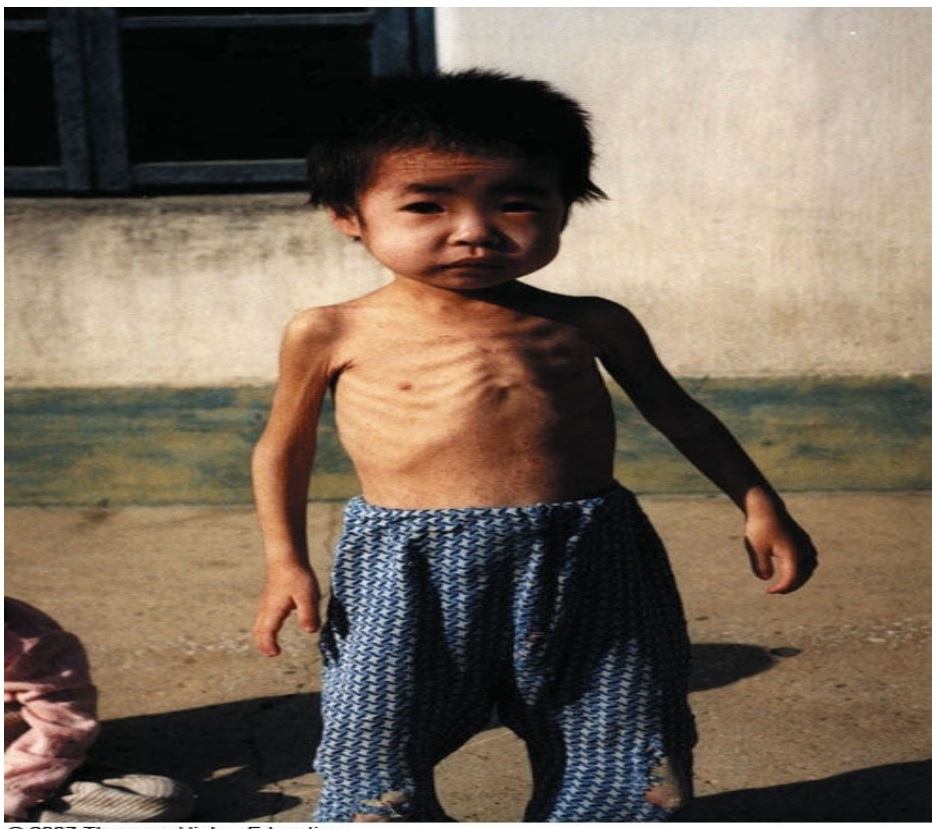
- Serum **Albumin levels 2-3 gm%**
- Serum **Cortisol levels increased**

Clinical Signs And Symptoms

- Marked **growth retardation**
- Severe **Muscle wasting**
- **Loss of sub cutaneous fat**
- Extreme **loss of body weight**
- **No Edema**

- **No mental changes**
- **No characteristic change in hair**
- **Appetite is normal**
- **Skin becomes dry and atrophic**
- **Child looks older than his age**

- Feels Hungry
- Diarrhoea & Dehydration
- Alert but miserable



Differentiation Between

Kwashiorkar

And

Marasmus

Features	Kwashiorkor Displaced Child	Marasmus Neglected Child
Age Of Onset	1-5 years	Below 1 year
Cause	Deficiency of dietary Protein	Deficiency Of dietary Proteins and Calories
Serum Albumin	< 2gm%	2-3 gm%
Edema	Significantly Present	Absent
Muscle Wasting	Not severe	Markedly sever
Growth Retardation	Present	Markedly noted

Features	Kwashiorkor	Marasmus
Attitude and Appearance	Lethargic ,apathetic Face looks plump	Irritable and fretful Shrunken with skin and bones
Appetite	Anorexia	Normal
Skin Changes	Crazy pavement Dermatitis	Dry and atrophic
Hair Changes	Sparse, soft thin and curly	No characteristic change
Serum Cortisol	Decreased	Increased

Investigations for PEM

- Full Blood Counts
- Blood Glucose
- Serum Electrolytes, Ca, P
- Serum Proteins and Albumin
- Septic screening
- Stool & urine for parasites & Microbes
- Mantoux test

NON-ROUTINE TESTS

- Hair analysis
- Skin biopsy
- Urinary Creatinine
- Measurement of trace elements levels, iron, zinc & Iodine

Complications of P.E.M

- Hypoglycemia
- Hypothermia
- Hypokalemia
- Hyponatremia
- Heart failure
- Dehydration & shock
- Infections (bacterial, viral & thrush)

Treatment

- **Slow refeeding**
  - –Small frequent feeding round the clock
  - –Patient encouragement of food
- **Nutritional rehabilitation**
  - –Play and teaching
  - –Control infections

In Acute/ life threatening Cases:

- **Fluid and Electrolytes**
  - K and Mg shifts
  - Oral rehydration, slowly 70-100 ml/kg
- **Infections: Main cause of death**
  - Aggressive treatment
- **Other deficiencies**
  - Anemia and Heart failure,
  - Care with transfusions and no diuretics
  - Vitamin A: immediate treatment

- Dietary support:
- **3-4 g protein & 200 Cal /kg body wt/day + Vitamins & Minerals**
- Prevention of hypothermia
- Counsel parents & plan future care including **immunization & diet supplements**.

KEY POINT FEEDING

- **Continue breast feeding**
- **Add frequent small feeds**
- **Use liquid diet**
- **Give vitamin A & Folic acid**
- **With diarrhea use lactose-free or soya bean formula**

PROGNOSIS

- **Kwashiorkor have greater risk of morbidity & mortality compared to Marasmus and under weight**
- **Early detection & adequate treatment are associated with good outcome**
- **Late ill-effects on IQ, behavior & cognitive functions are doubtful and not proven**

Over Nutrition Disorders

Obesity

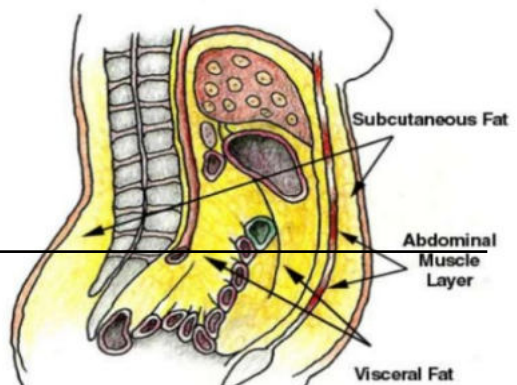
INTRODUCTION

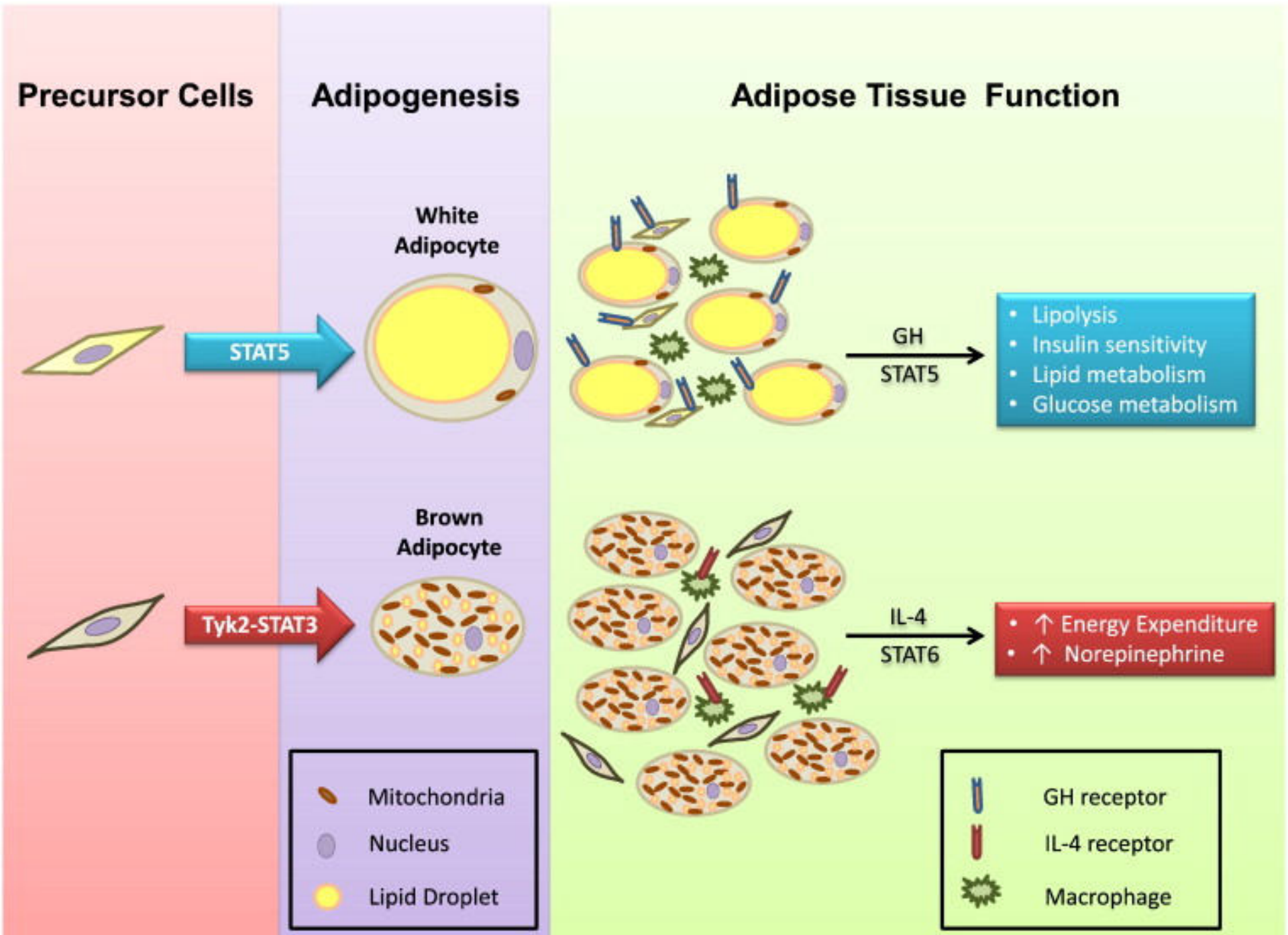
- obesity is increased body weight due to excess deposition of fat.
- *Global scenario .*
- *Body can deal with excess fat in three ways.*
- *Adipose tissue has important endocrine functions.*
- It is measured by BMI = $\frac{\text{weight in kg}}{(\text{height in meter})2}$

  provides a relative weight adjusted for height.
- Anatomical distribution in fat deposition can be measured by waist-to-hip ratio.

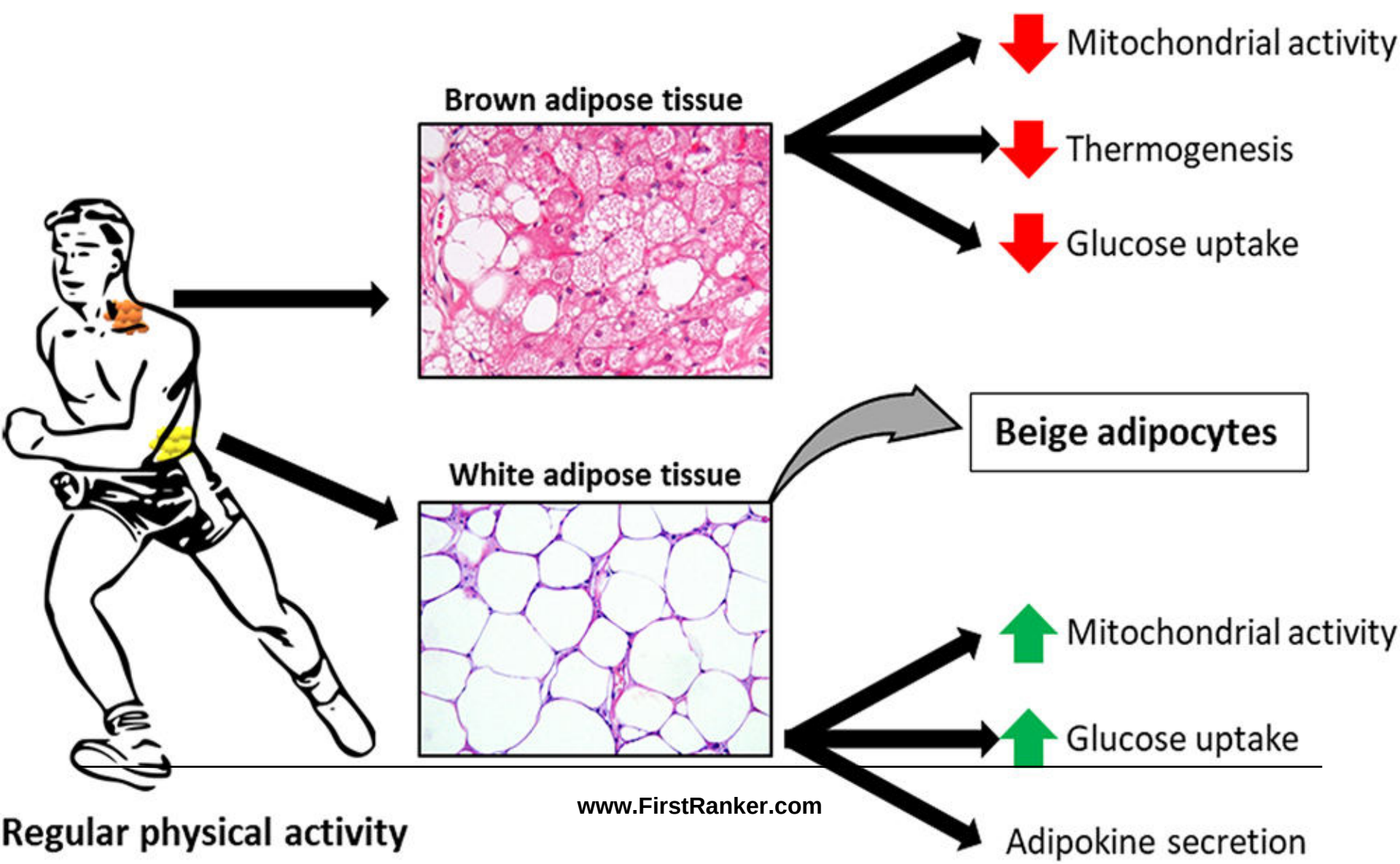
  upper abdominal obesity- men >1.0,
  women >o.8

  lower abdominal obesity- men<1.0
  women <0.8

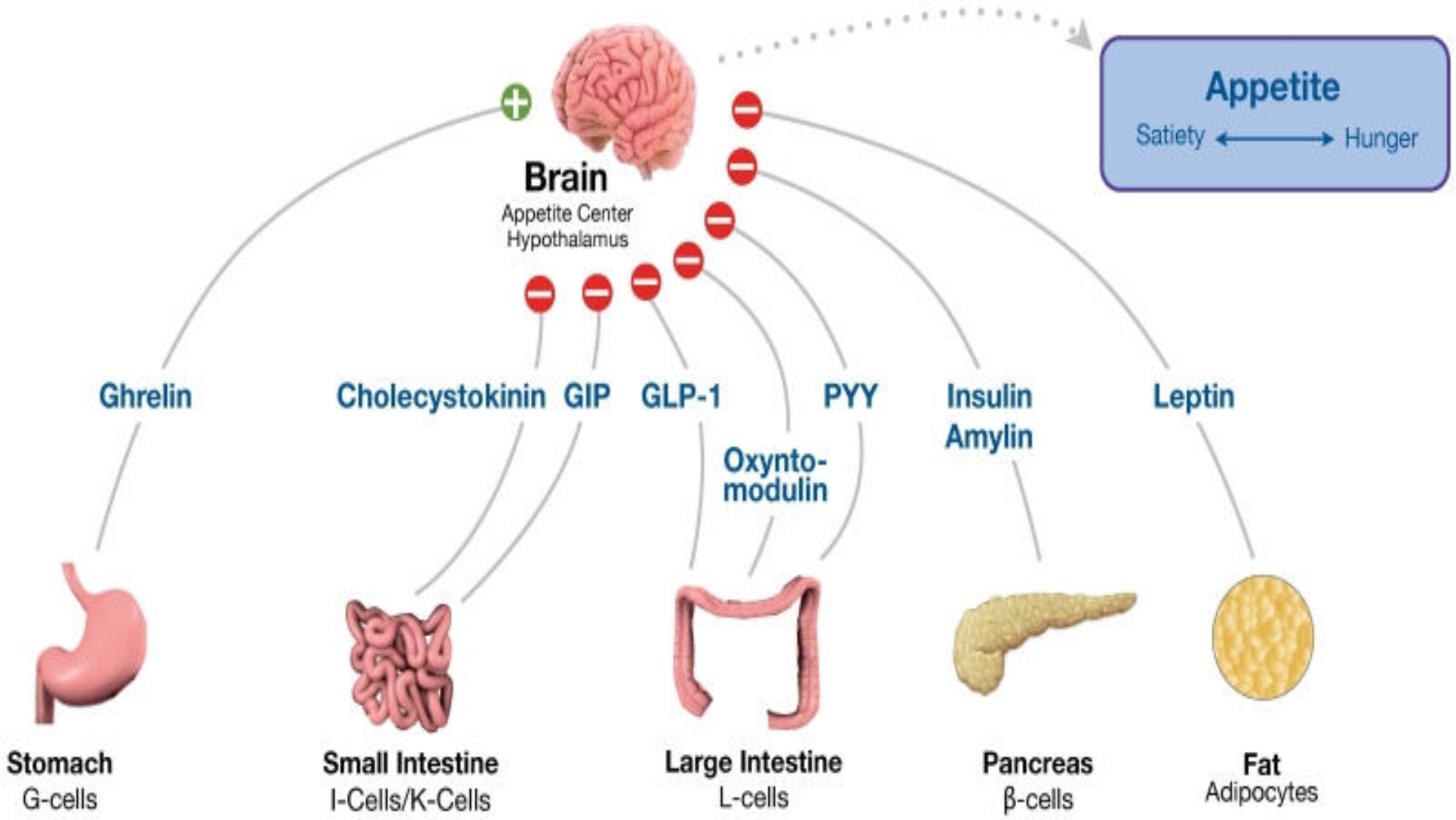




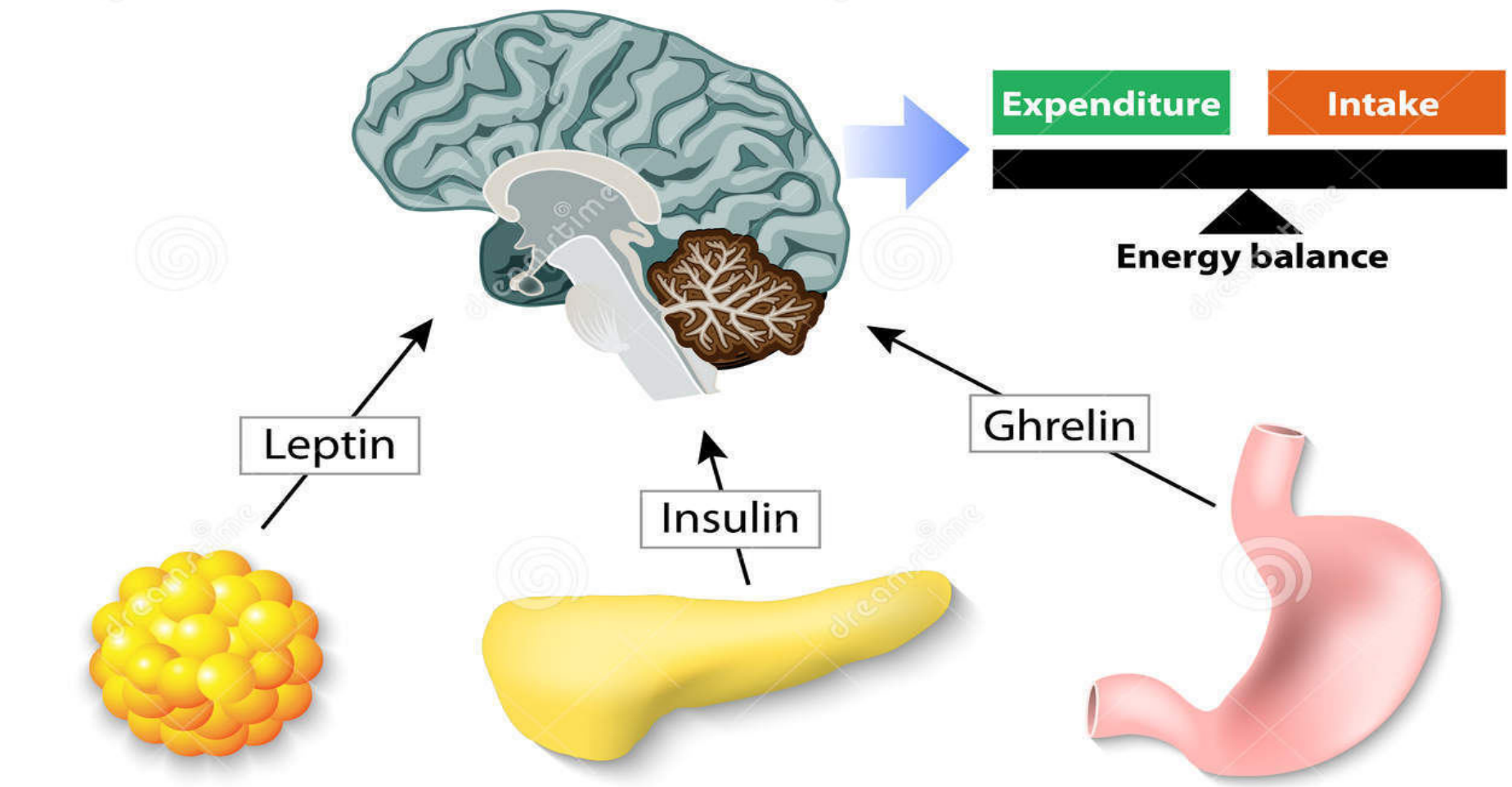
Types Of Adipose Tissue And Roles



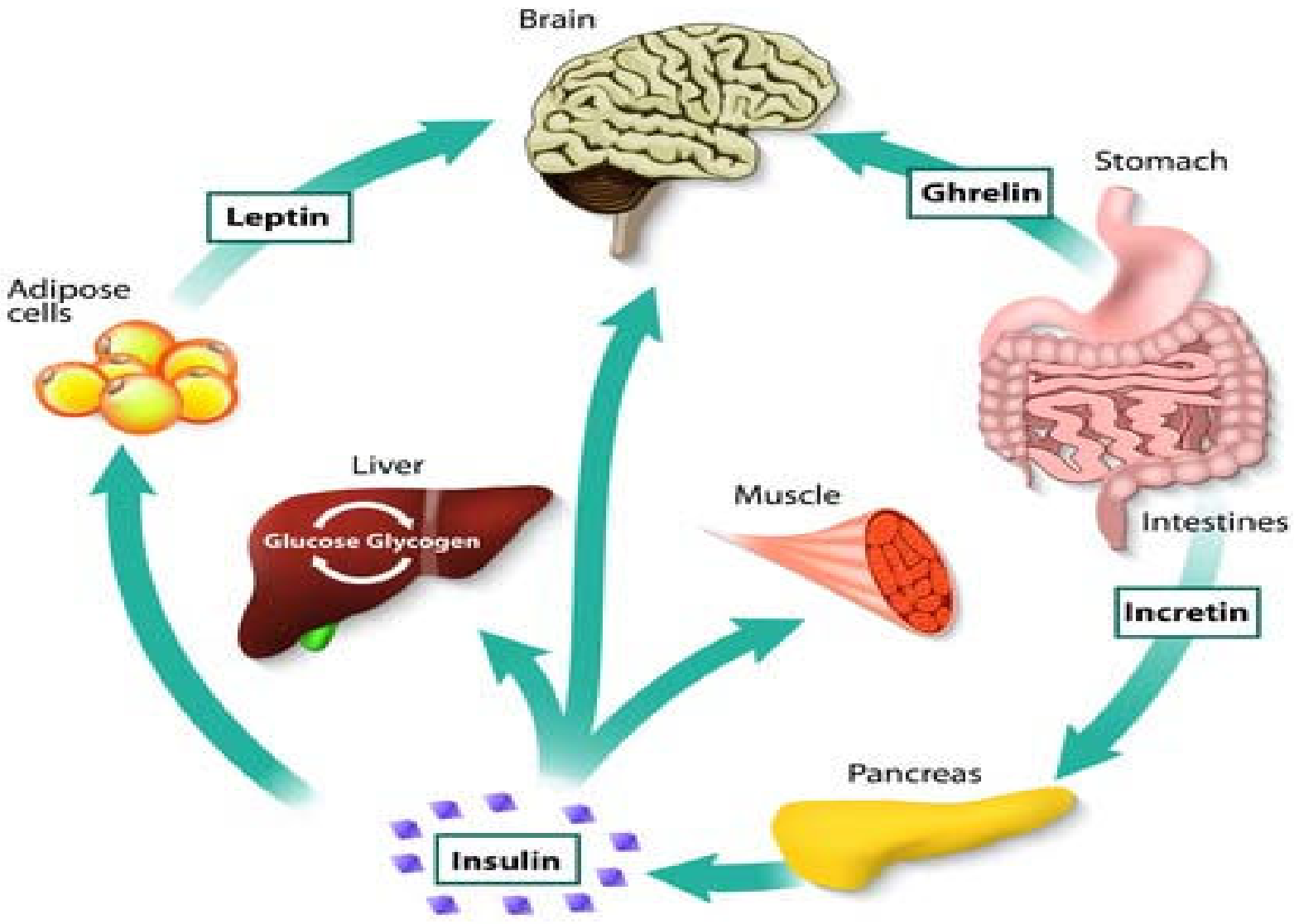
Appetite Related Hormones



CONTROL OF FOOD INTAKE



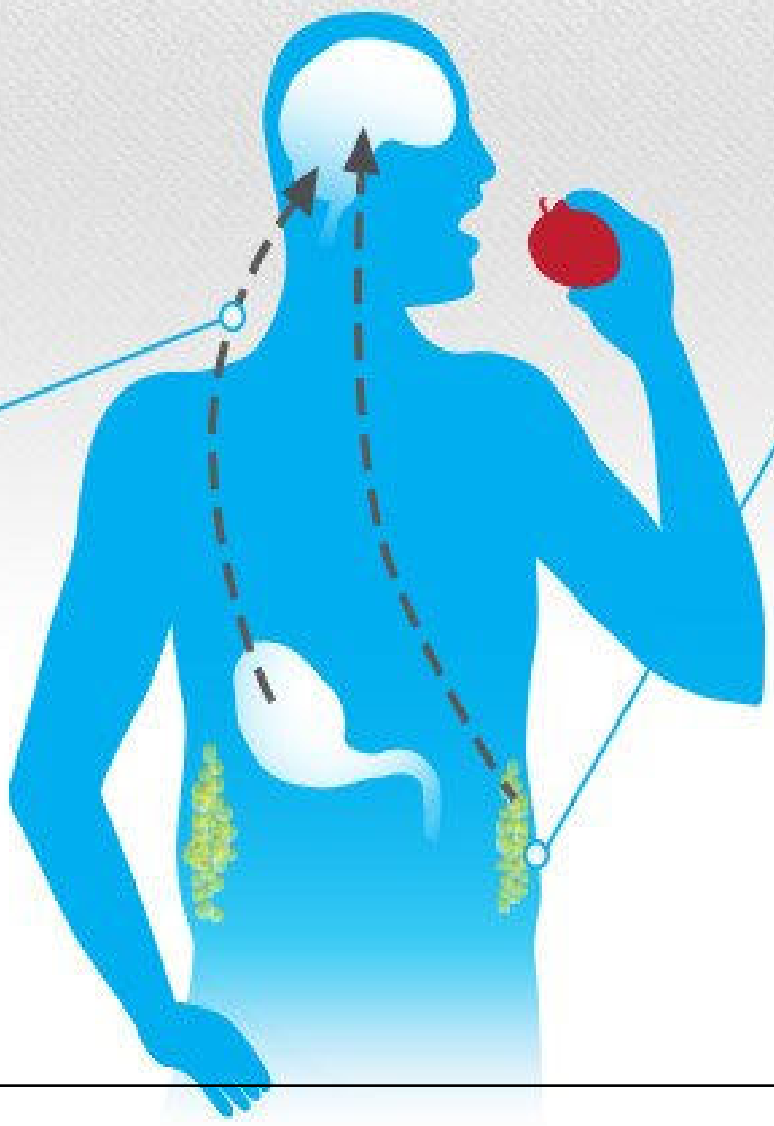
APPETITE & HUNGER
(hormones)



HOW GHRELIN AND LEPTIN WORK IN THE BODY

GHRELIN
THE APPETITE STIMULATOR

Ghrelin is released from the stomach, and when elevated, sends a signal to your brain letting you know you're hungry and it's time to eat! Age, gender, blood glucose, and leptin levels can all affect ghrelin levels.



LEPTIN
THE APPETITE SUPPRESSOR

Leptin, which is stored and secreted by fat cells, is considered to be the master regulator of hunger. When you eat a meal, leptin is released from fat cells and sends a signal to your brain to let you know you're full and to stop eating.

LEPTIN AND WEIGHT-GAIN CYCLE

GAIN WEIGHT
As you gain more fat mass, the number of fat cells increase, as do leptin levels.

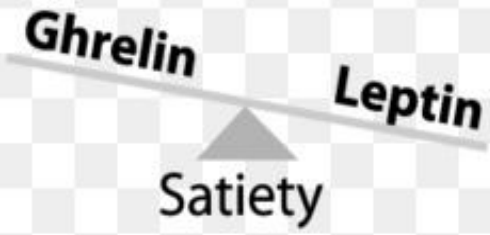
LEPTIN RESISTANCE
As you increase fat stores and whole-body inflammation, your body develops leptin resistance.

DISRUPTED SIGNAL
Even though you have an abundance of stored fat and leptin, the signal to your brain gets disrupted.

OVEREATING
The brain senses low leptin levels, leading to food cravings and overeating.

INCREASED CALORIE INTAKE
Even though you increase calorie intake, you are continually hungry, which leads to continued weight gain.

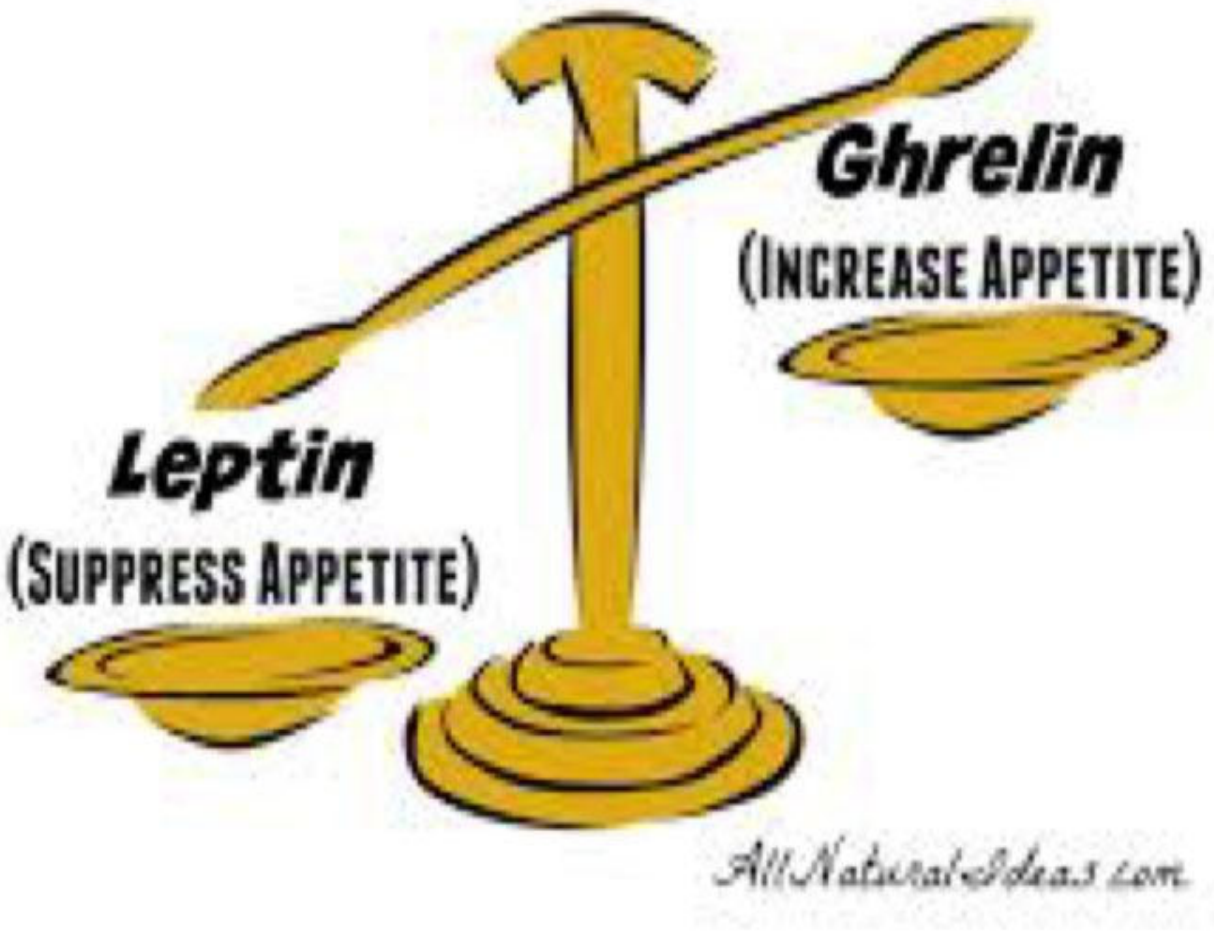
LEPTIN & GHRELIN



BEFORE EATING

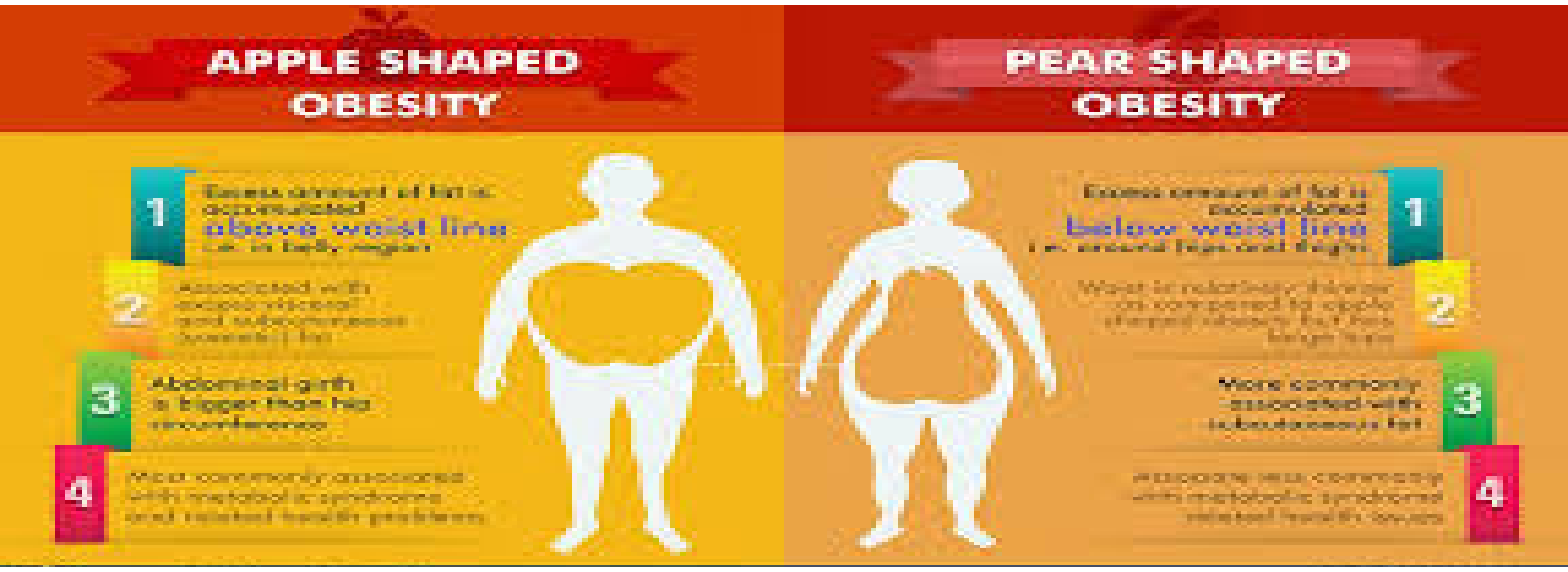
AFTER EATING

Getting Your Leptin & Ghrelin in Balance



Obesity

- Generalized, excessive accumulation of fat in subcutaneous & other tissues



- Classification of Obesity according to "desirable" standard weight :
  - Overweight ~ ≥10%
  - Obese ~ ≥20%

Obesity Is Identified By Measurement Of Body Mass Index (BMI)

$$\text{Body Mass Index} = \frac{\text{Weight (in kg)}}{\text{Height}^2 \text{ (in m)}}$$

OBESITY

Body Mass Index (BMI)

$$BMI = \frac{\text{weight (kg)}}{\text{height}^2\ \text{(m)}}$$

BMI	NIH Classification
<18.5	Underweight
18.5-24.9	Normal Weight
25-29.9	Overweight
30-34.9	Obesity I
35-39.9	Obesity II
>40	Extreme Obesity

BMI CHART

weight (kilograms)

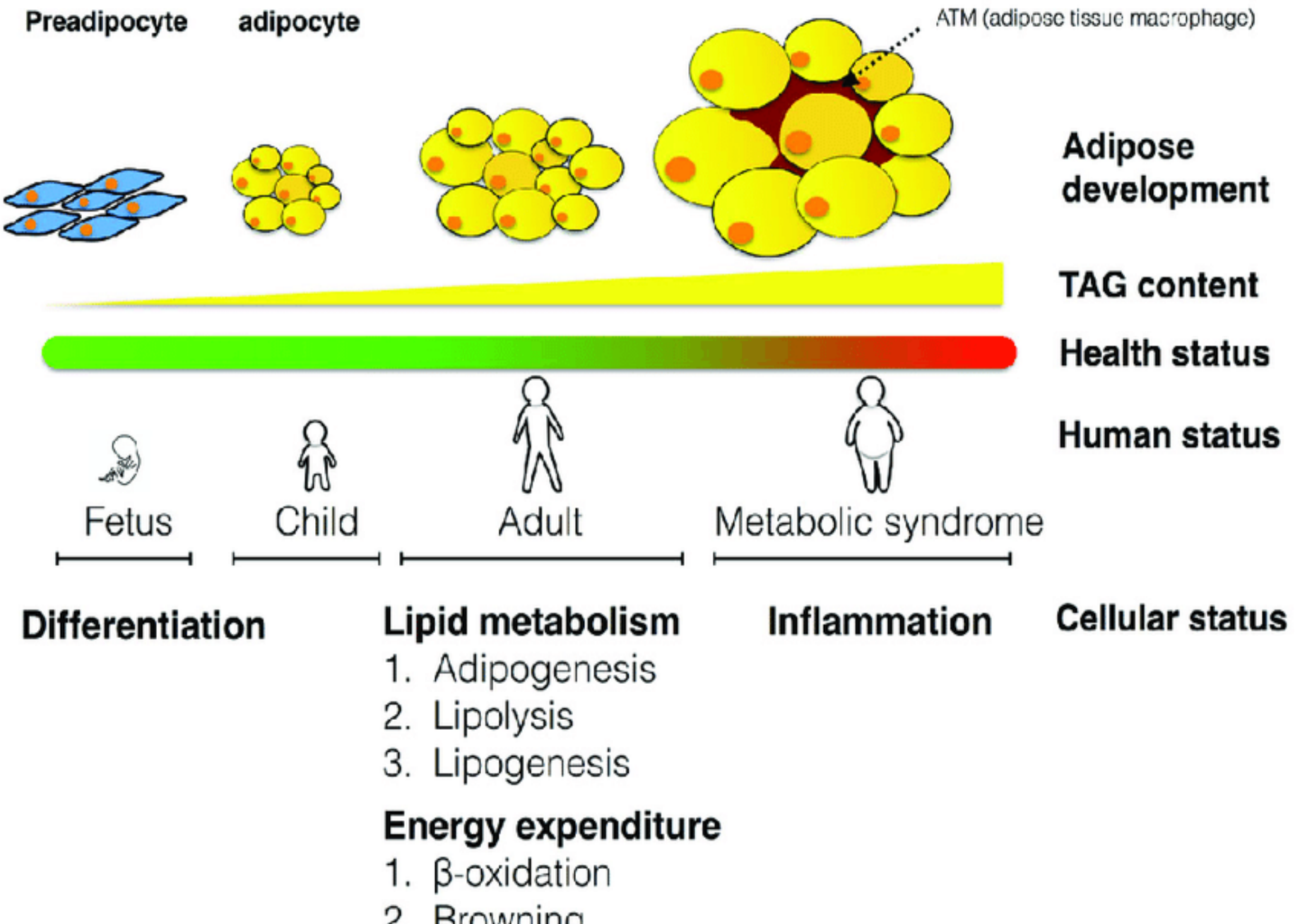
height (meters)	height squared	50	60	70	80	90	100	110	120	130
2.0	4.0	12.5	15.0	17.5	20.0	22.5	25.0	27.5	30.0	32.5
1.9	3.6	13.9	16.6	19.4	22.2	24.9	27.7	30.5	33.2	36.0
1.8	3.2	15.4	18.5	21.6	24.7	27.8	30.9	34.0	37.0	40.1
1.7	2.9	17.3	20.8	24.2	27.7	31.1	34.6	38.1	41.5	45.0
1.6	2.6	19.5	23.4	27.3	31.3	35.2	39.1	43.0	46.9	50.8
1.5	2.3	22.2	26.7	31.1	35.6	40.0	44.4	48.9	53.3	57.8
1.4	2.0	25.5	30.6	35.7	40.8	45.9	51.0	56.1	61.2	66.3
1.3	1.7	29.6	35.5	41.4	47.3	53.3	59.2	65.1	71.0	76.9
1.2	1.4	34.7	41.7	48.6	55.6	62.5	69.4	76.4	83.3	90.3
1.1	1.2	41.3	49.6	57.9	66.1	74.4	82.6	90.9	99.2	107.4

height (meters)	height squared	140	150	160	170	180	190	200	210	220
2.0	4.0	35.0	37.5	40.0	42.5	45.0	47.5	50.0	52.5	55.0
1.9	3.6	38.8	41.6	44.3	47.1	49.9	52.6	55.4	58.2	60.9
1.8	3.2	43.2	46.3	49.4	52.5	55.6	58.6	61.7	64.8	67.9
1.7	2.9	48.4	51.9	55.4	58.8	62.3	65.7	69.2	72.7	76.1
1.6	2.6	54.7	58.6	62.5	66.4	70.3	74.2	78.1	82.0	85.9
1.5	2.3	62.2	66.7	71.1	75.6	80.0	84.4	88.9	93.3	97.8
1.4	2.0	71.4	76.5	81.6	86.7	91.8	96.9	102.0	107.1	112.2
1.3	1.7	82.8	88.8	94.7	100.6	106.5	112.4	118.3	124.3	130.2
1.2	1.4	97.2	104.2	111.1	118.1	125.0	131.9	138.9	145.8	152.8
1.1	1.2	115.7	124.0	132.2	140.5	148.8	157.0	165.3	173.6	181.8

What Causes Obesity

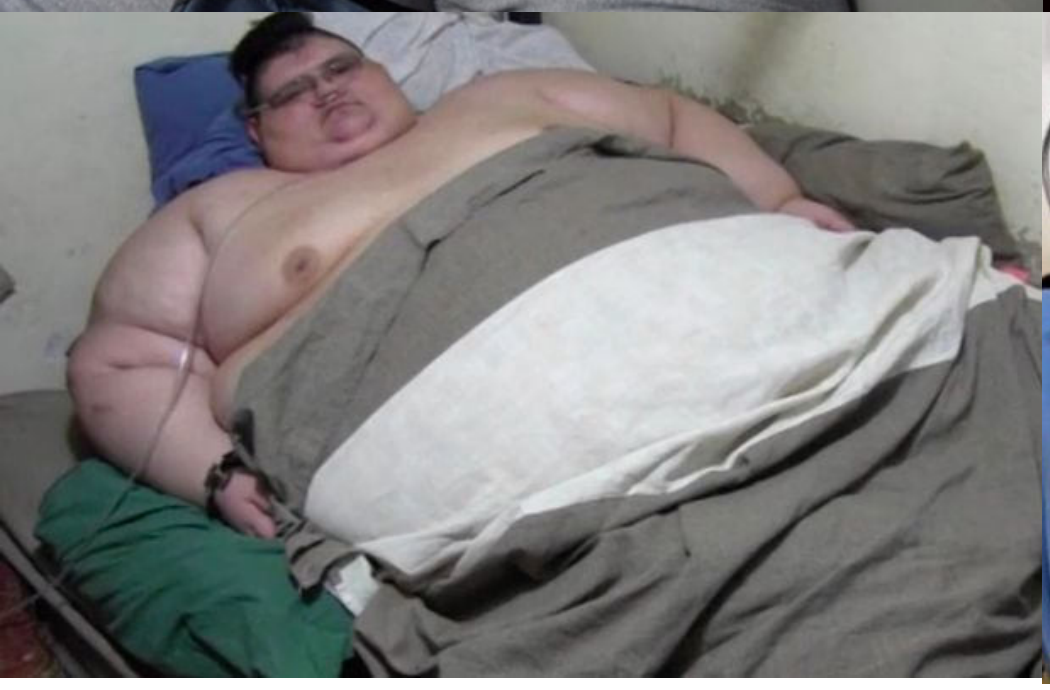
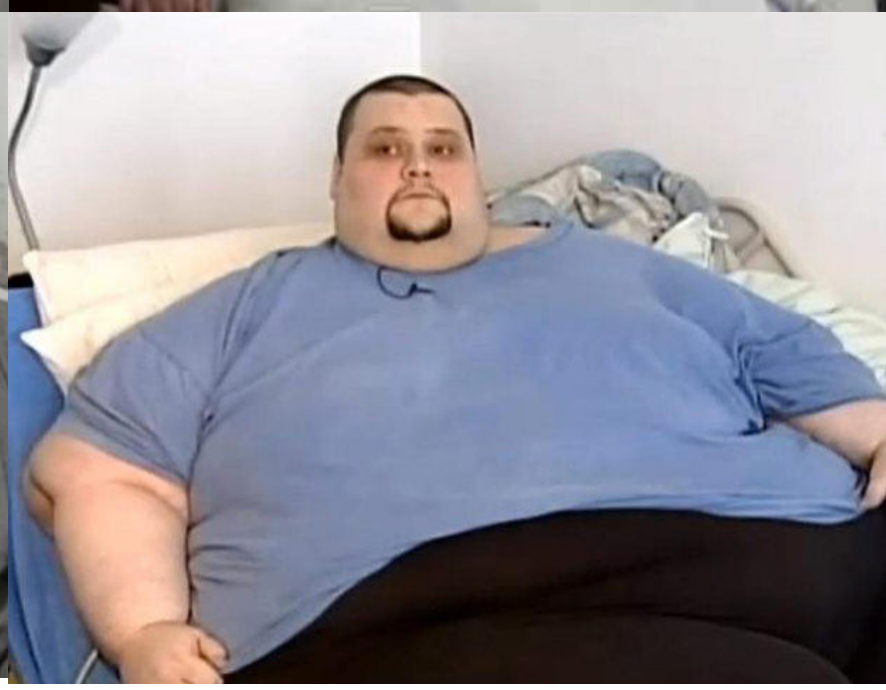
- **3 major factors** contribute for development of obesity:
  - **Genetic background (non-modifiable)**
  - **High Dietary intake (modifiable)**
  - **Low Physical activity (modifiable)**

- ❑ **Psychic disturbances**
- ❑ **Endocrine & metabolic disturbances (rare)**



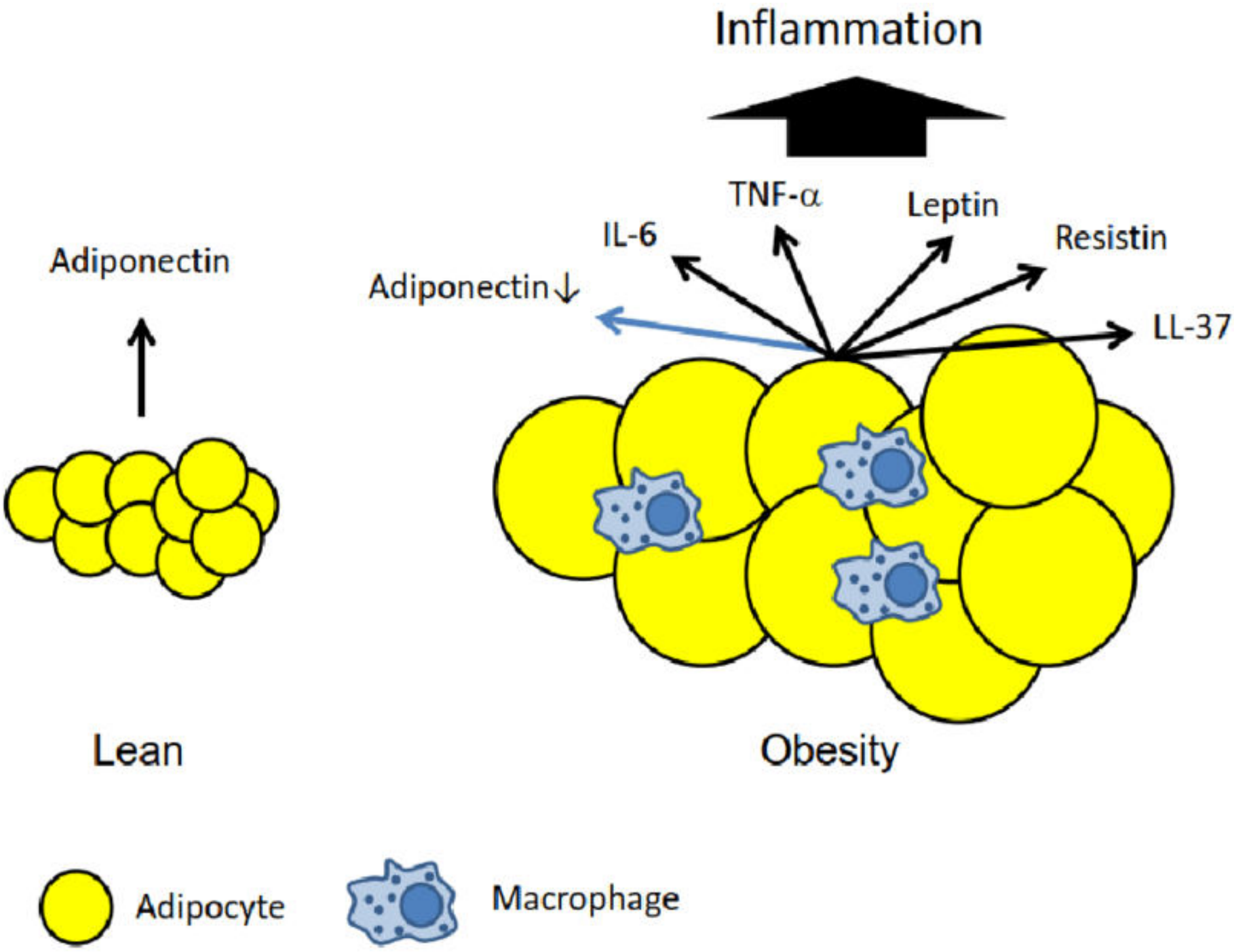
Obesity Affects Quality Of Human Life



Biochemical Alterations Of Obesity

- Increased stores of TAG in adiposecytes
- Increased biosynthesis of Endogenous Lipids
- Affects receptor structures on cell membrane
- Derangements in endocrine activity
- Increased risk of Diabetes mellitus
- Biochemical Derangements in Glucose and Lipid Profile
- Increased Risk of Atherosclerosis , CAD , Stroke

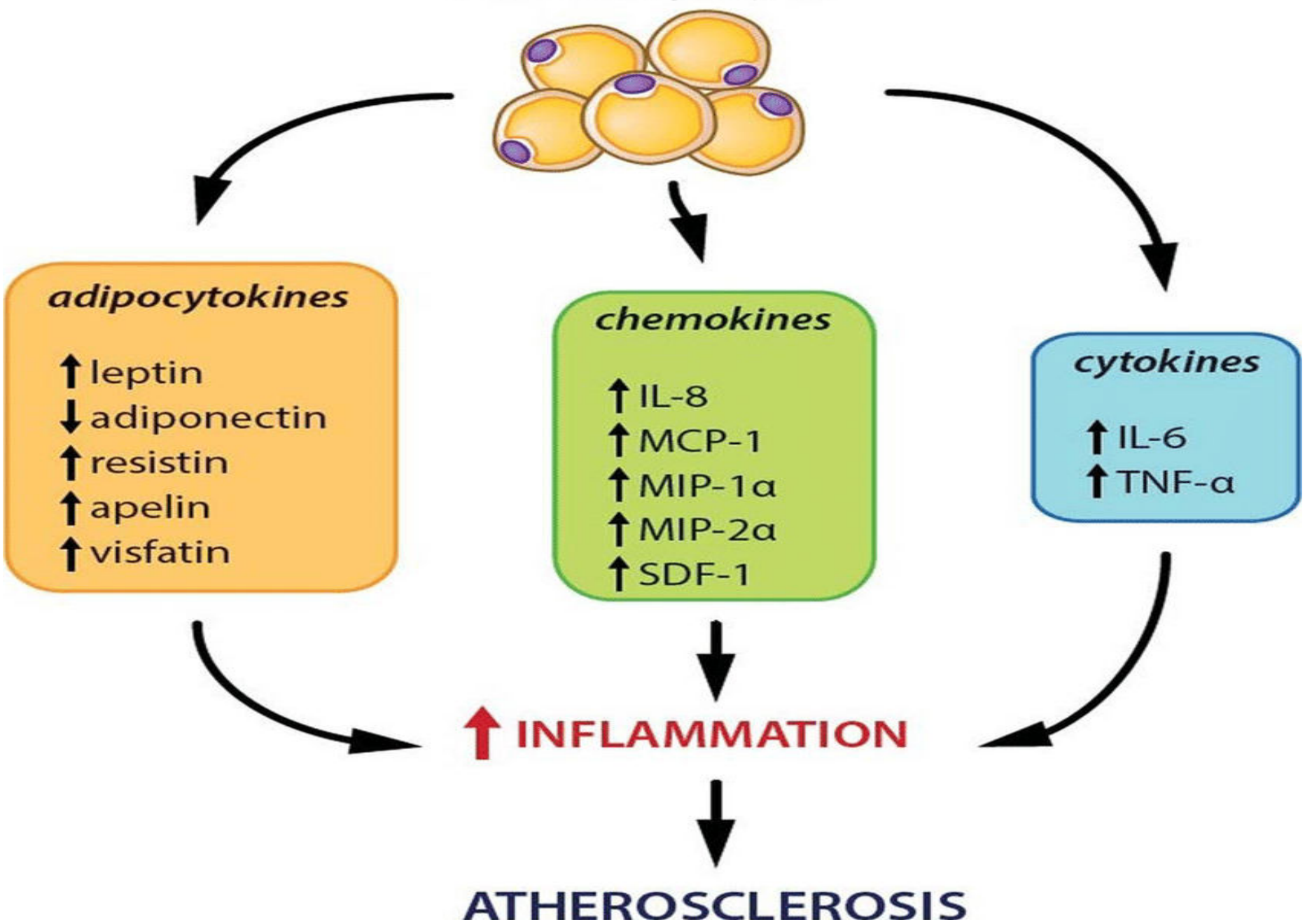


Dysregulation of Adipocytokines in Obesity

- **Adipocytokines function** as **classic circulating hormones**

- **Communicate** with **other organs including brain, liver, muscle, the immune system, and adipose tissue itself.**

- Dysregulation of **Adipokines** has been implicated to increases **inflammation, insulin resistance , type 2 diabetes, and cardiovascular disease**.



Leptin and Adiponectin

Regulate Feeding Behavior and Energy Expenditure

Leptin

- **Leptin** is a hormone that is produced **mainly by Adiposecytes.**
- " **Leptin's** primary target is in **hypothalamus of brain**
- “Leptin is a Master" Hormone that **regulates body weight**.
- It is often referred to as **"satiety hormone" or "starvation hormone.**
- **Leptin dampens/ suppresses appetite**

Leptin

- A peptide hormone.
- 167 aa residue
- 16 kd
- OB Gene encodes leptin ,Located in chr no 7 in human.
- Secreted dominantly by adipocytes and little amount intestinal wall, placenta etc.
- Shows diurnal variation.
- Discovered by Dr. Jeffrey Friedman’s team on 1994.
- Derived the name from Greek word Leptos- thin
- Product of **OB** gene.
- **DB** gene encodes leptin receptor.

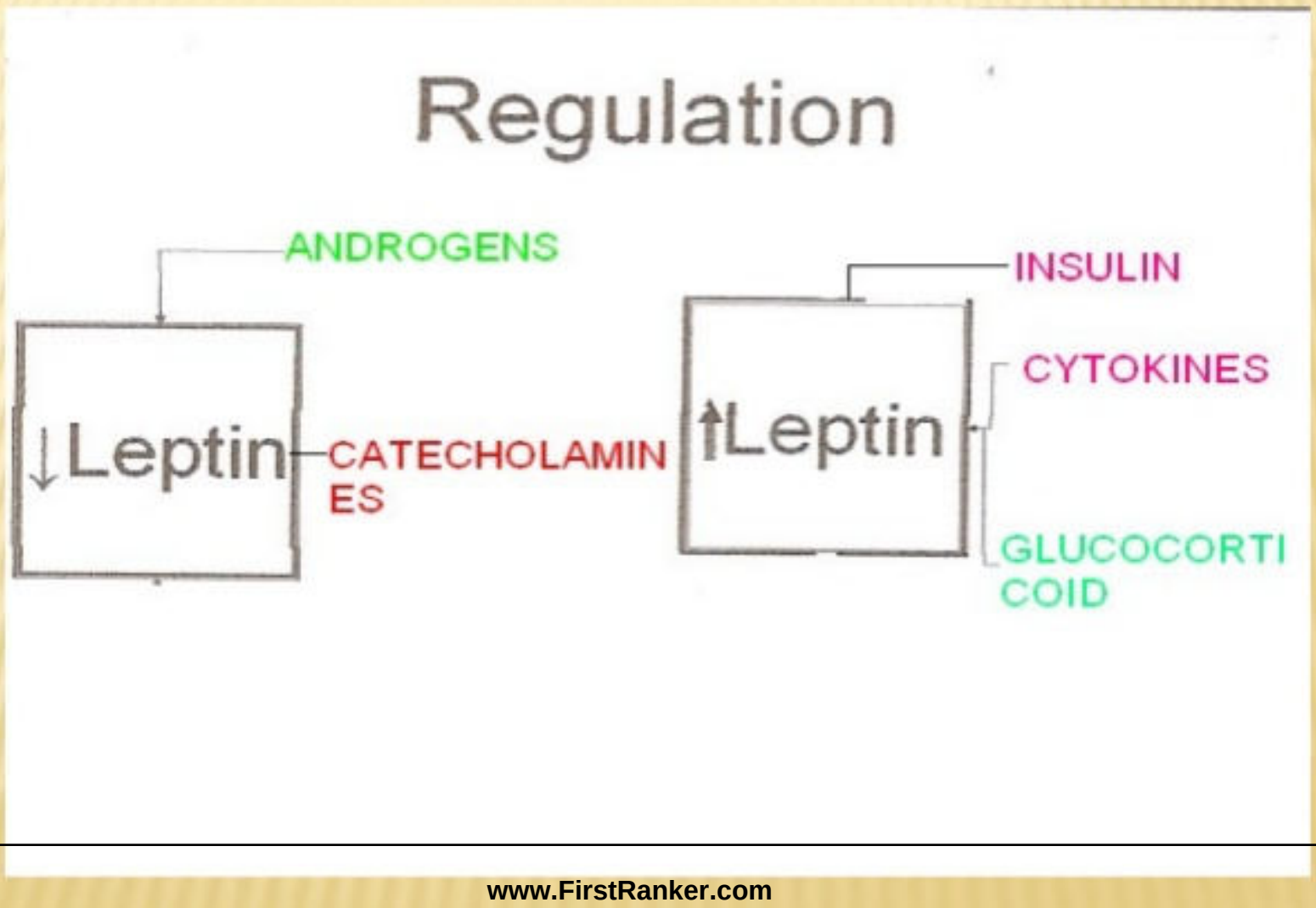
Leptin synthesis

- *White adipose tissue (WAT) is the main site of leptin synthesis, but it is now evident that it is also produced in other tissues , including placenta, ovaries, skeletal muscle and stomach and brown adipose tissue as well.*

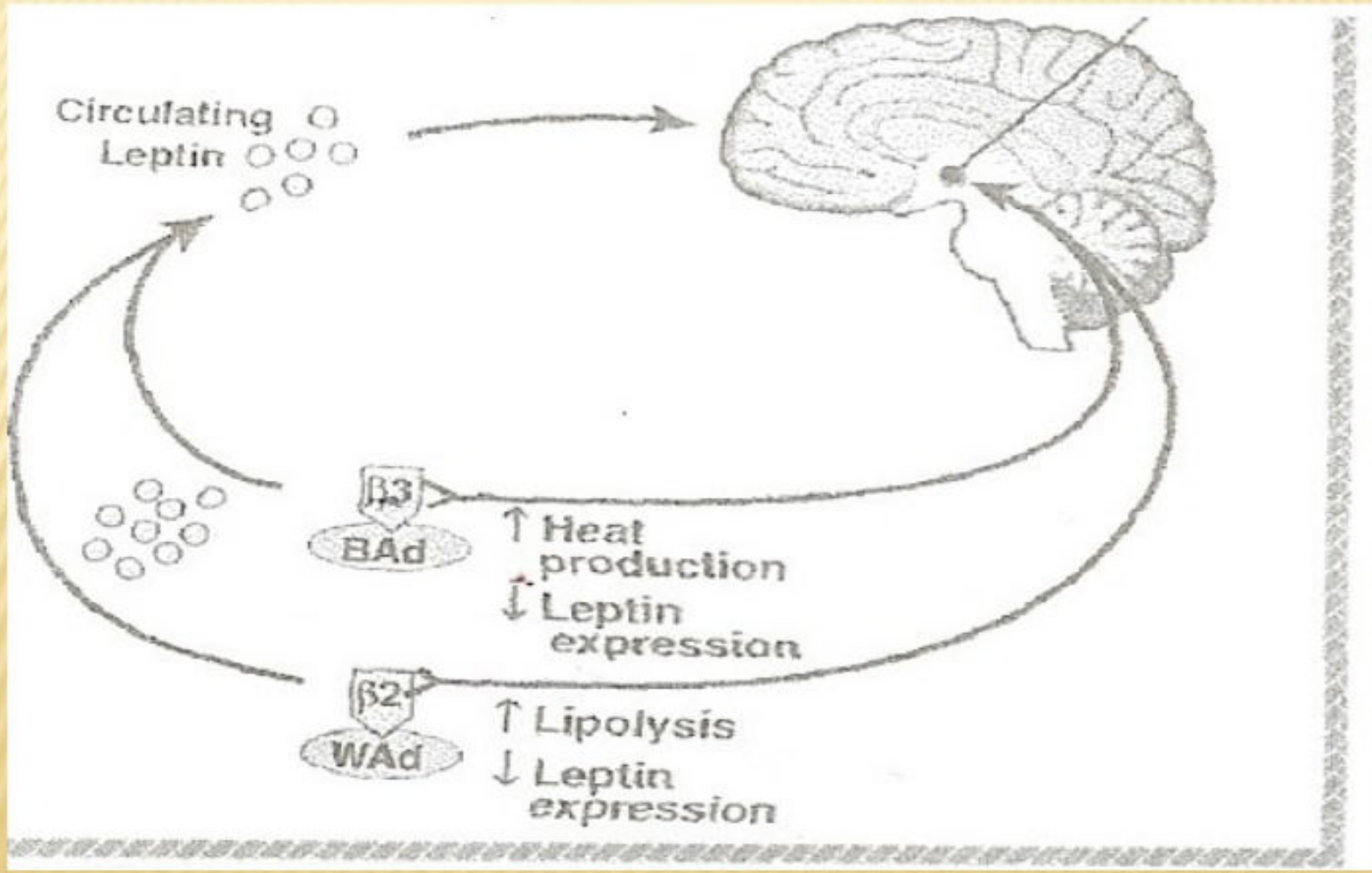
- *Transcription of the leptin gene in mice yields a mRNA of ~3.5 kb that is expressed primarily in adipose tissues, but recent studies have confirmed that some other tissues also express leptin.*

- *In humans, leptin is encoded by a gene located in human chromosome 7q31.3 and is similar to that in rodents.*

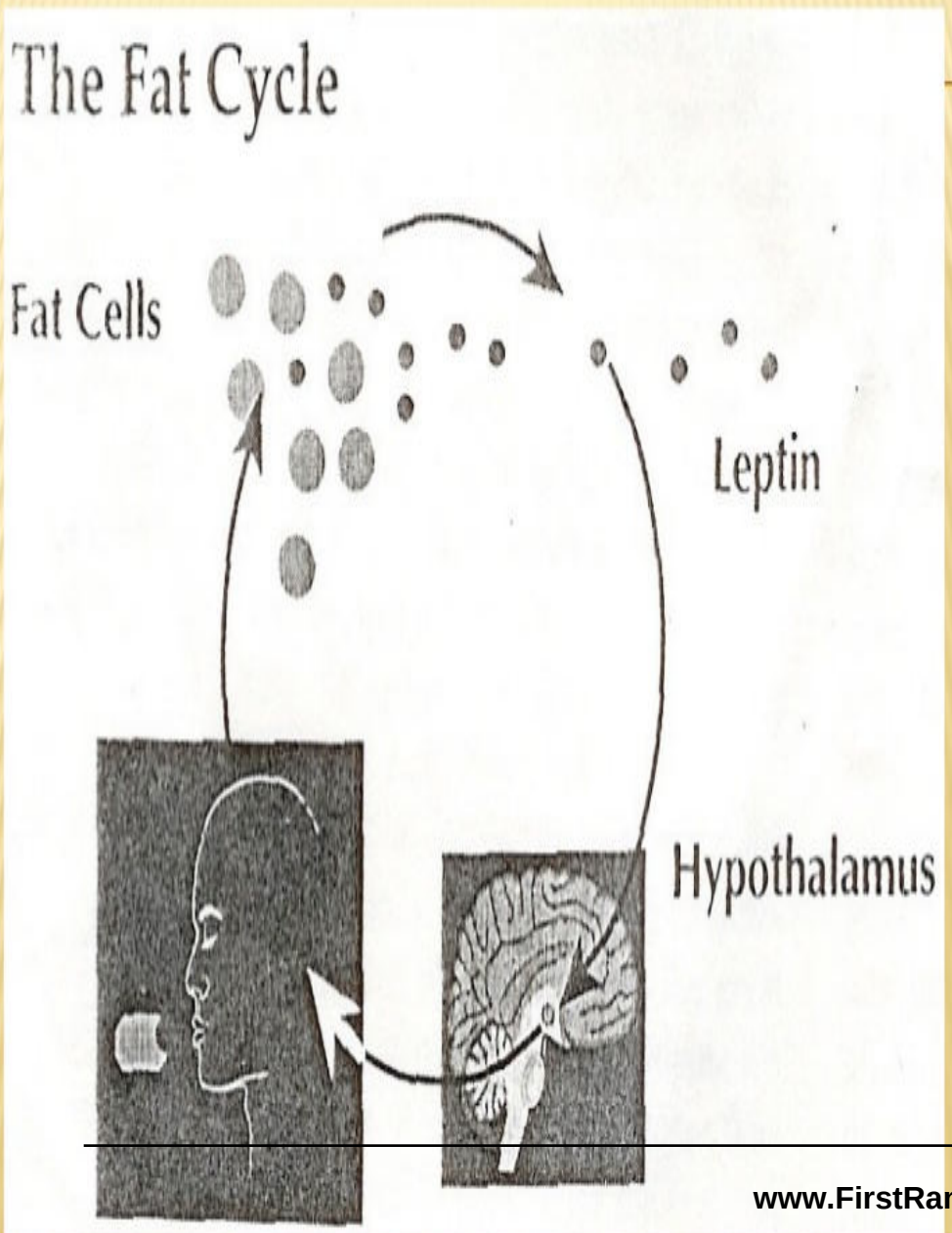
LEPTIN REGULATION



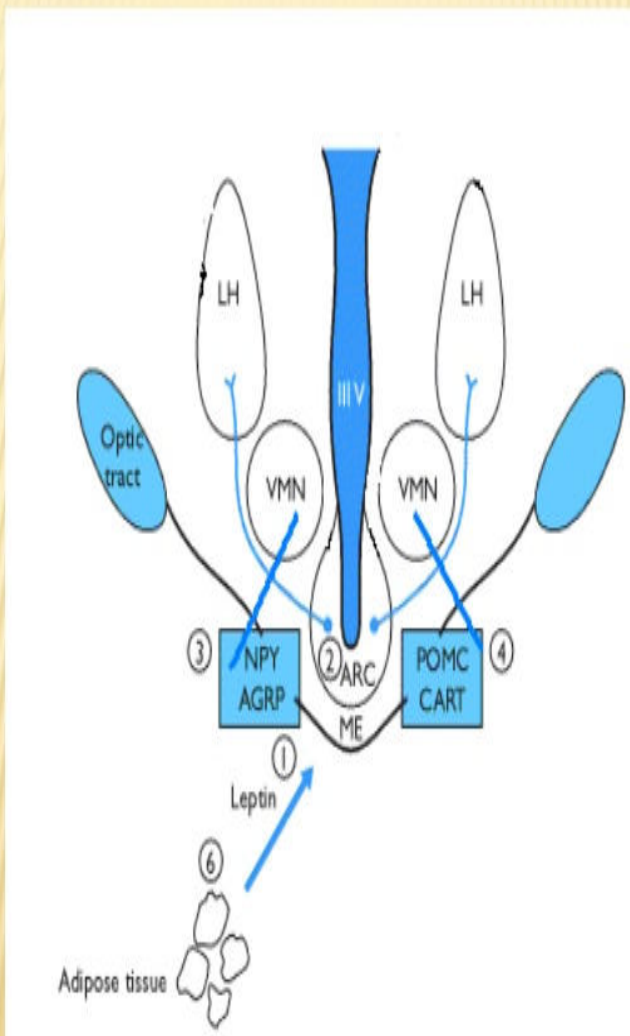
ENERGY HOMEOSTASIS



THE FAT CYCLE

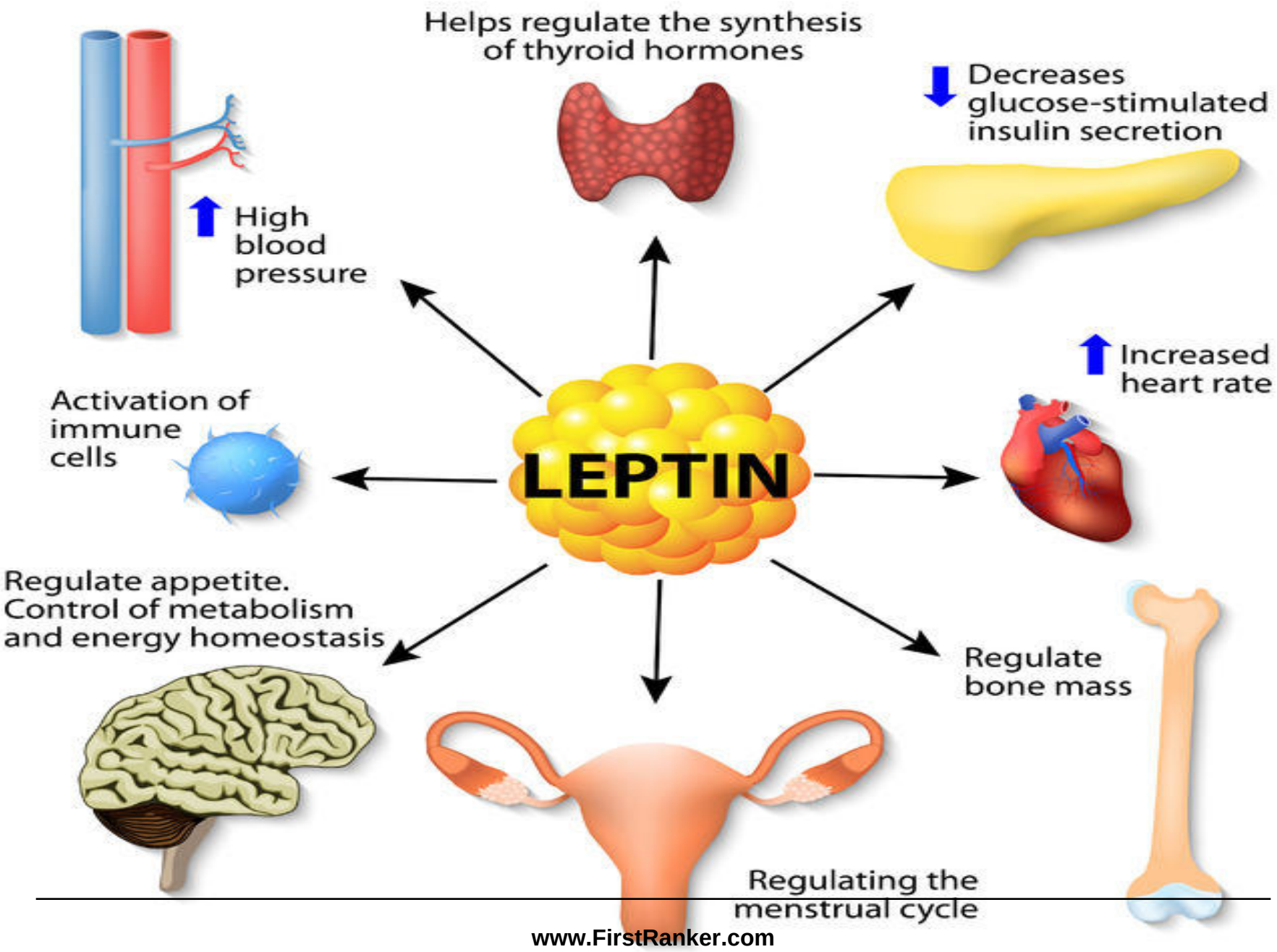


LEPTIN & HYPOTHALAMUS



Leptin recepters

- Leptin acts on receptors in the lateral hypothalamus to inhibit hunger and the medial hypothalamus to stimulate satiety.
- In the lateral hypothalamus, leptin inhibits hunger by counteracting the effects of neuropeptide Y.
- In the medial hypothalamus, leptin stimulates satiety by promoting the synthesis of α-MSH, a hunger suppressant .
- Thus, a lesion in the lateral hypothalamus causes anorexia (due to a lack of hunger signals) and a lesion in the medial hypothalamus causes excessive hunger (due to a lack of satiety signals)



Clinical utility

- *OB gene mutant/ defective ,Leptin deficient obese persons are benefitted with leptin injection.*
- *DB gene mutant/ defective obese persons are benefitted with combined leptin and amylin therapy. Weight reduction as much as 13%.*
- *Leptin increases insulin sensitivity to receptor but high level causes resistance.*
- *Leptin resumes fertility in leptin deficient.*

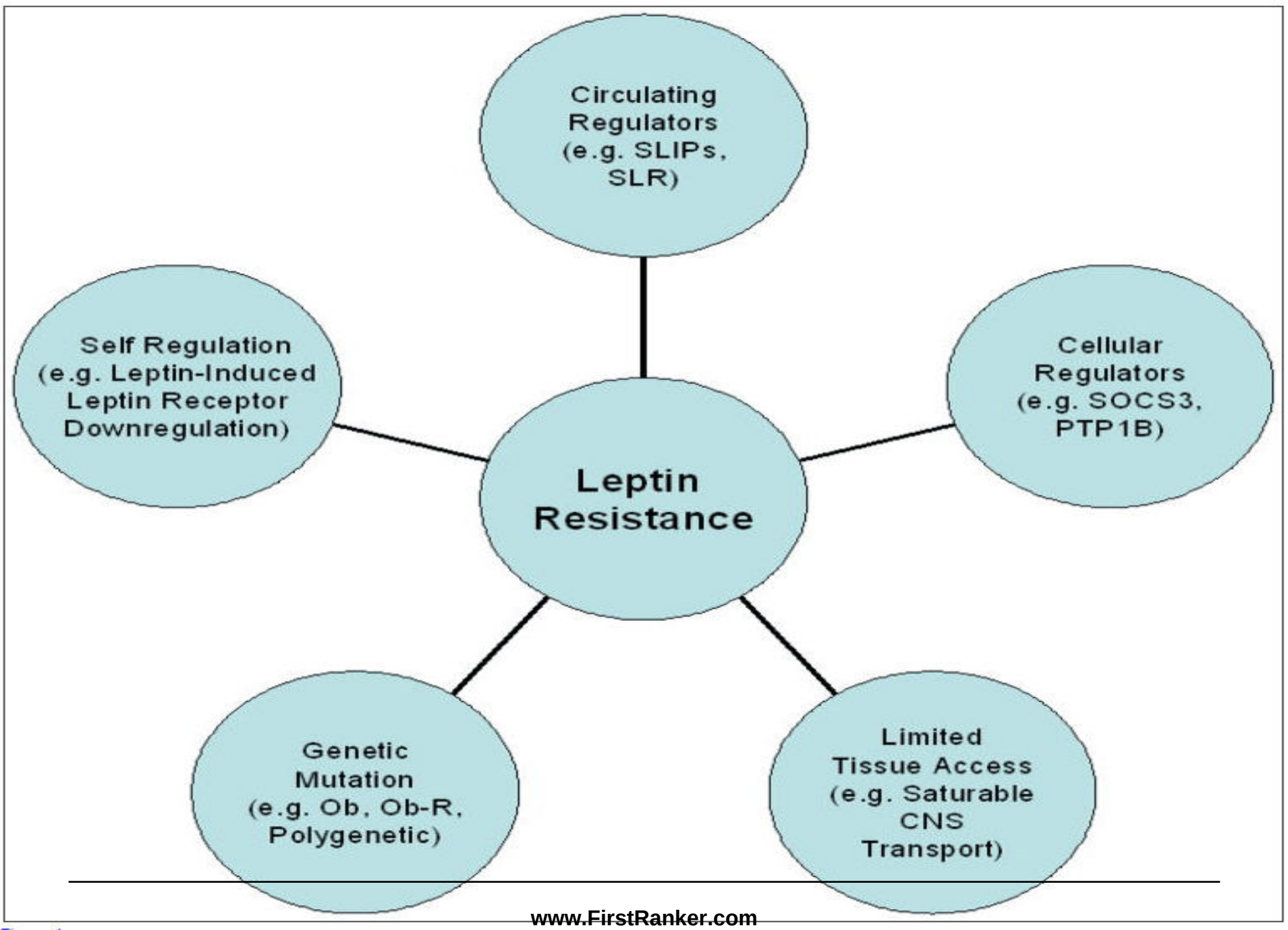


Figure 1
Mechanisms of leptin resistance

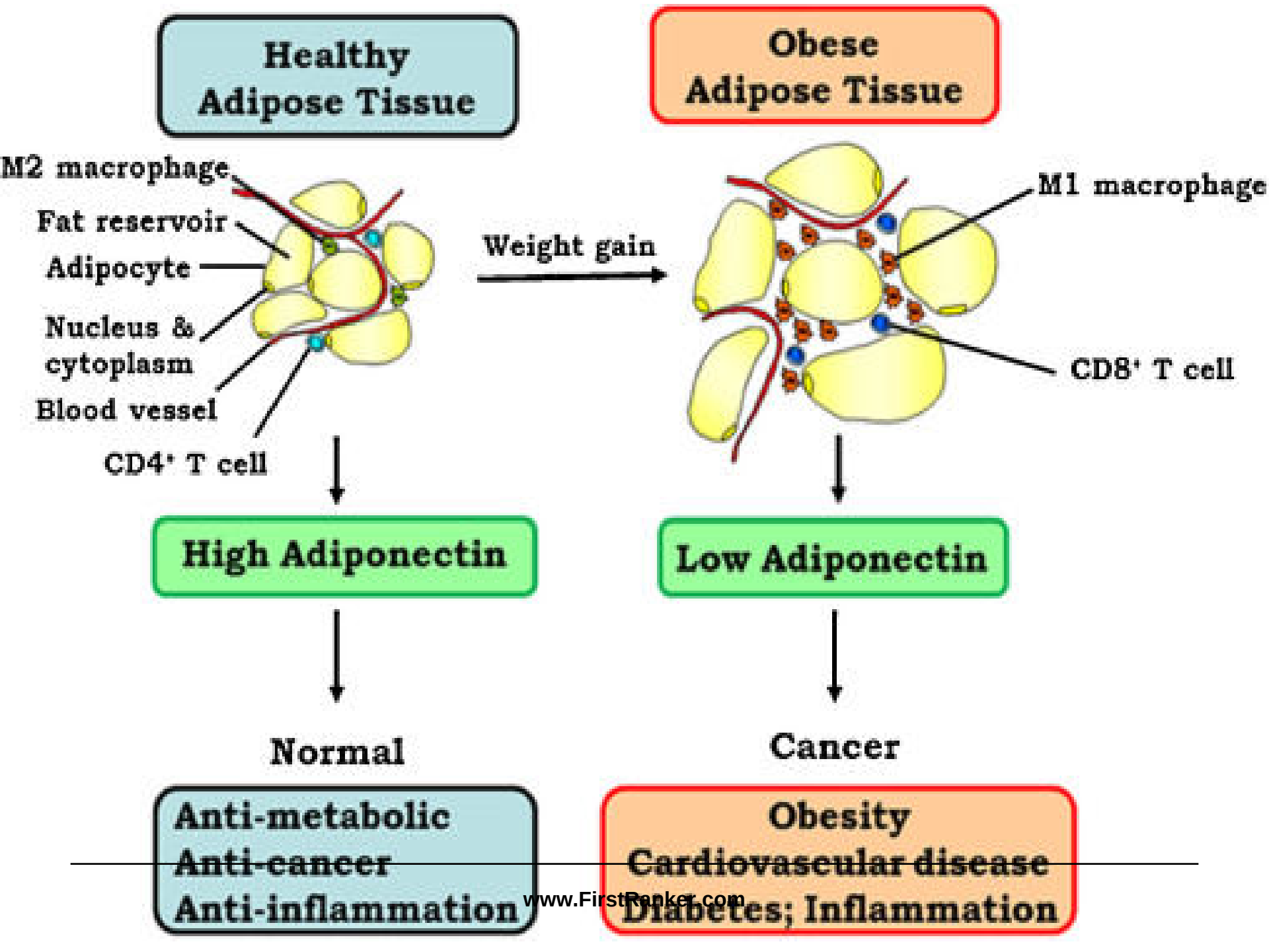
An individual **lacking a functional leptin** protein or receptor manifested **voracious feeding** and leads to **obesity**

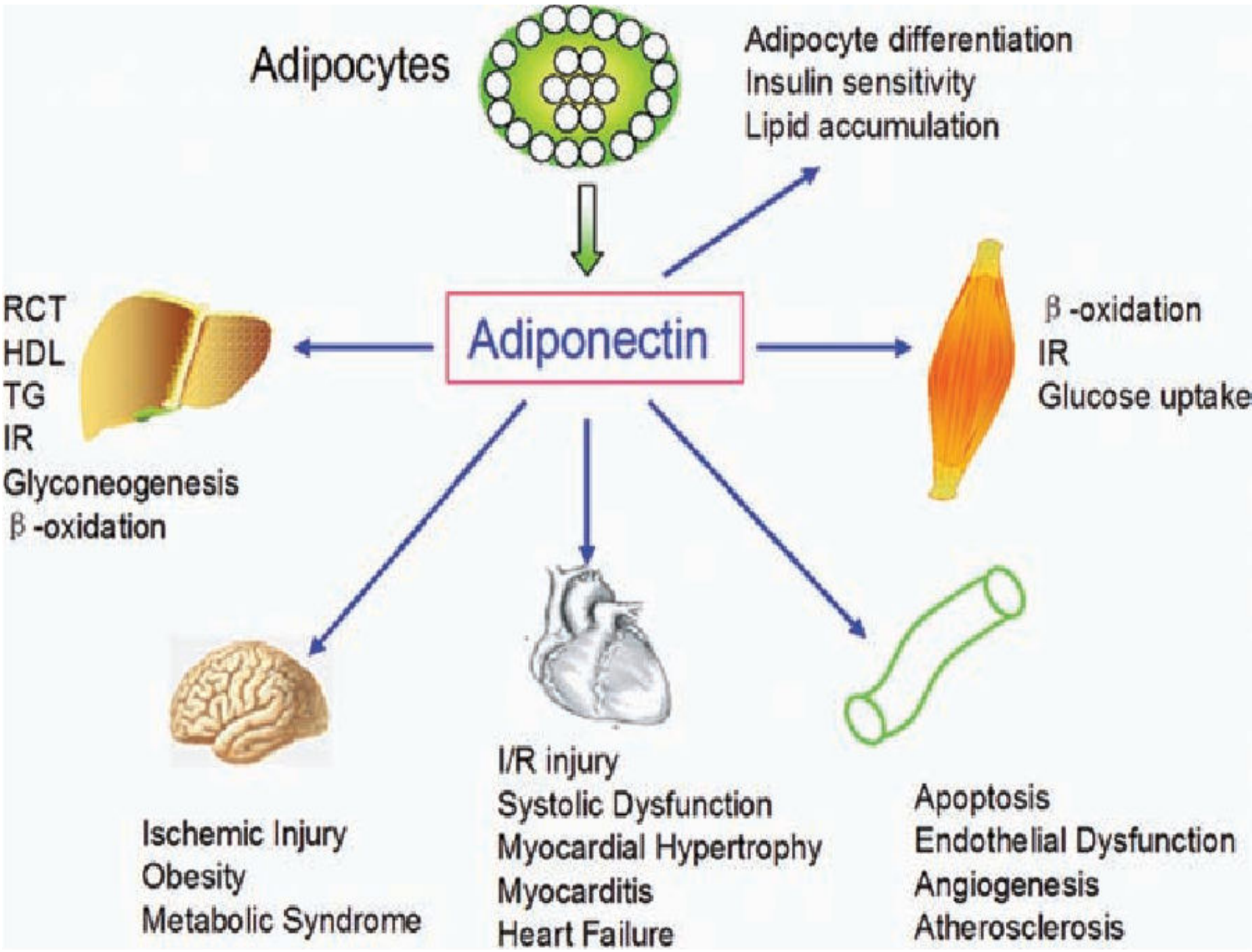
Adiponectin

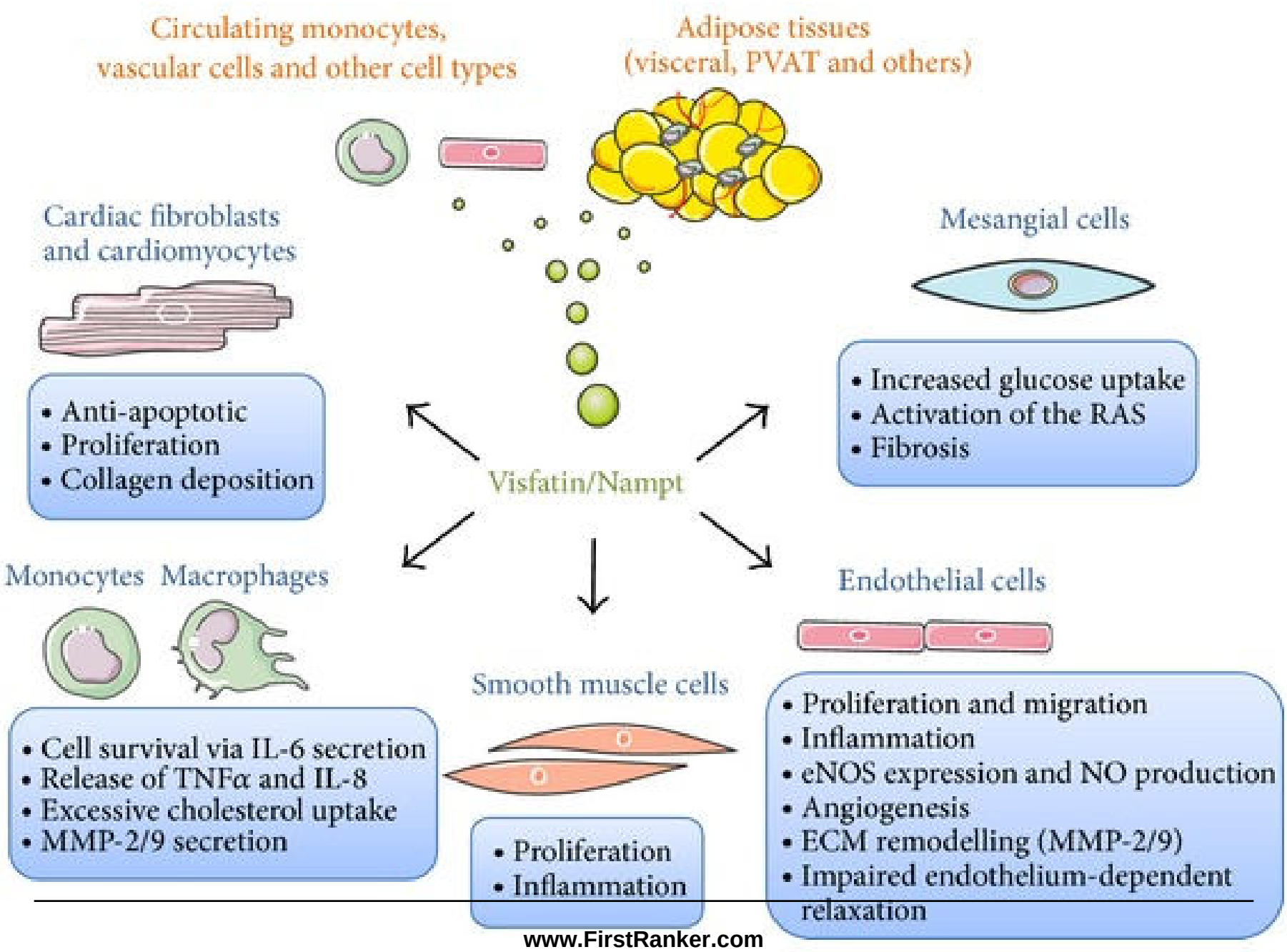
- **ADIPOQ gene**
- Produced in adipose tissue
- Protein hormone involved in
  - **Blood Glucose regulation**
  - **Fatty acid breakdown and oxidation**

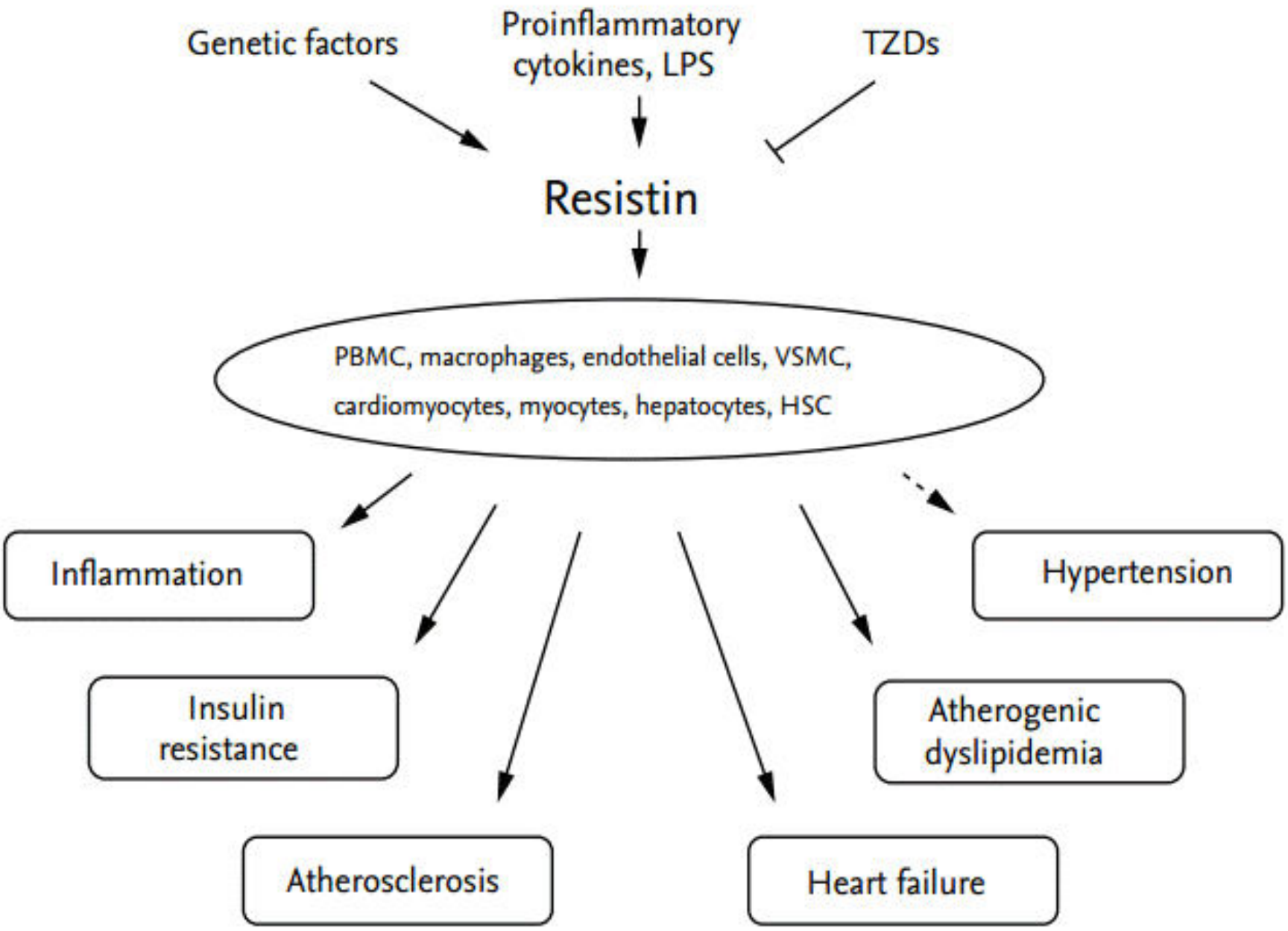
- Adiponectin **reduces inflamation**
- Adiponectin **inversely correlated with body mass index**

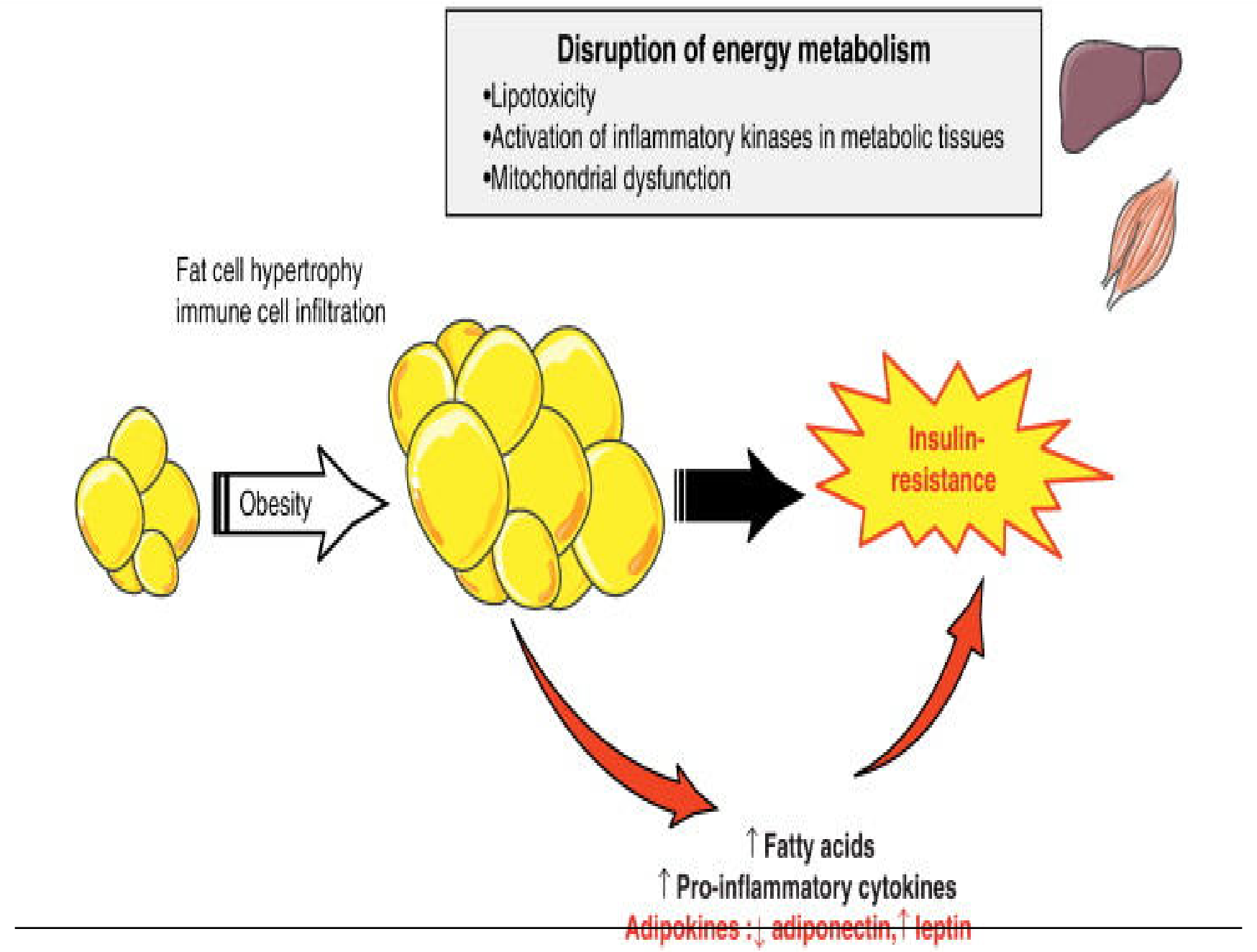
Adiponectin mRNA serum levels are decreased in obesity











Inflammation
Insulin resistance
Adipokine action

Vascular disorder

Fibrinolysis
Vascular diseases
Vessel wall remodeling
Adipokine action

IL-6

TGFβ

PAI-1

Chemerin
Apelin
Visfatin
MCP1

Inflammation

Adipose Tissue

Resistin

Inflammation
Insulin resistance

FGF21

Browning
Thermogenesis

TNFα

Adiponectin

Leptin

Food intake
Energy expenditure
Immune response
Reproduction
β-cell function
Hematopoiesis
Angiogenesis
Osteogenesis

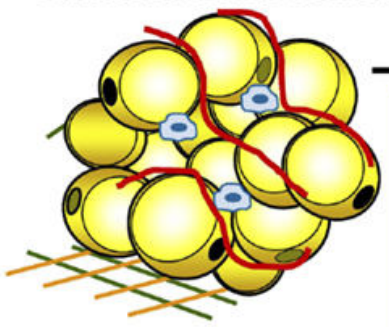
Insulin resistance
Inflammation
Lipolysis
Adipogenesis
Adipokines action

Insulin sensitivity
Energy expenditure
Inflammation
Suppression
Cell growth

Cell survival | Cardiovascular protection | Gastrointestinal function

LEAN individual: NORMAL STRUCTURE AND FUNCTION

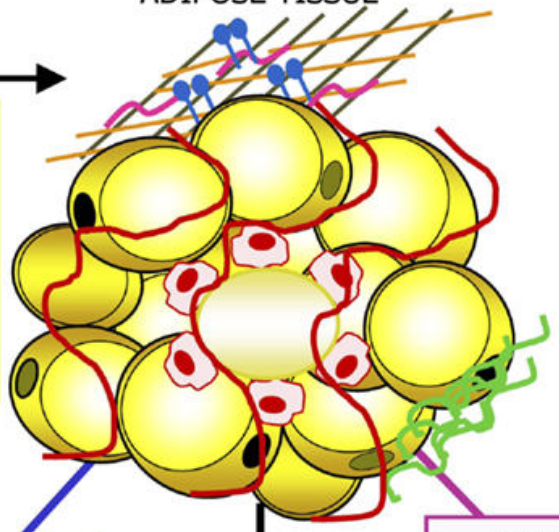
OBESE subject: DYSFUNCTIONAL ADIPOSE TISSUE

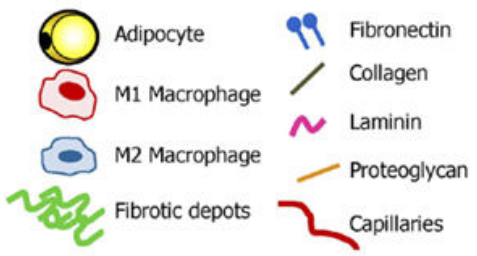


Adipocyte hypertrophy and hyperplasia

Lipid accumulation

Macrophages recruitment & phenotypic switch initiation





Increased expression of: CRP, IL-6, PAI-1, OPN, TNF-α, MCP-1, YKL-40 (among others)

INFLAMMATION

INSULIN RESISTANCE

HYPOXIA-ANGIOGENESIS

Increased expression of: HIF-1α, MMPs, TGF-β (among others)

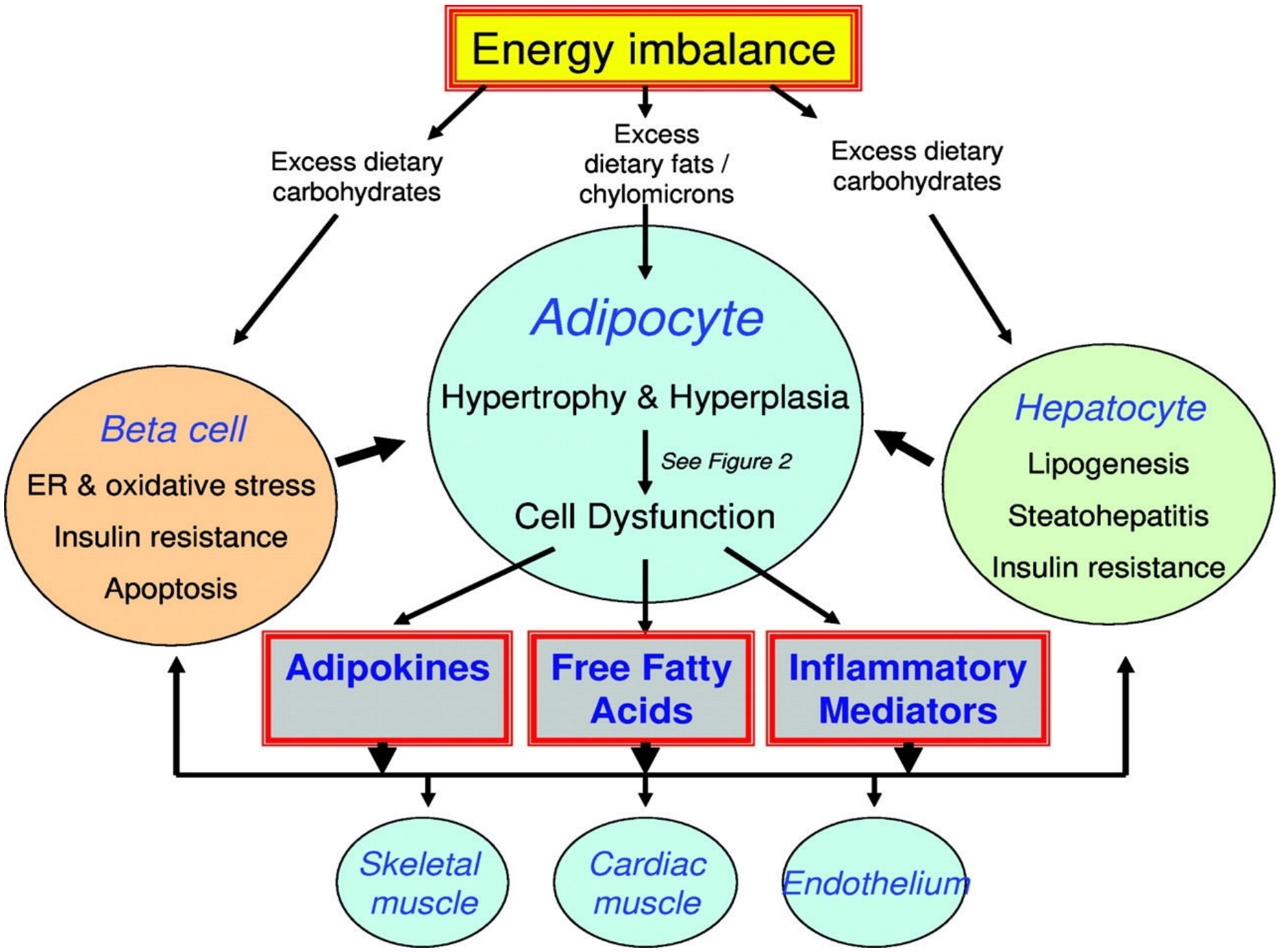
Increased expression of: Insulin, IGF
Decreased expression of: IGFBPs

Sustained inflammatory signalling

Chronic hyperinsulinaemia

Angiogenesis and ECM remodelling

MICROENVIROMENT FAVOURABLE FOR TUMOUR DEVELOPMENT

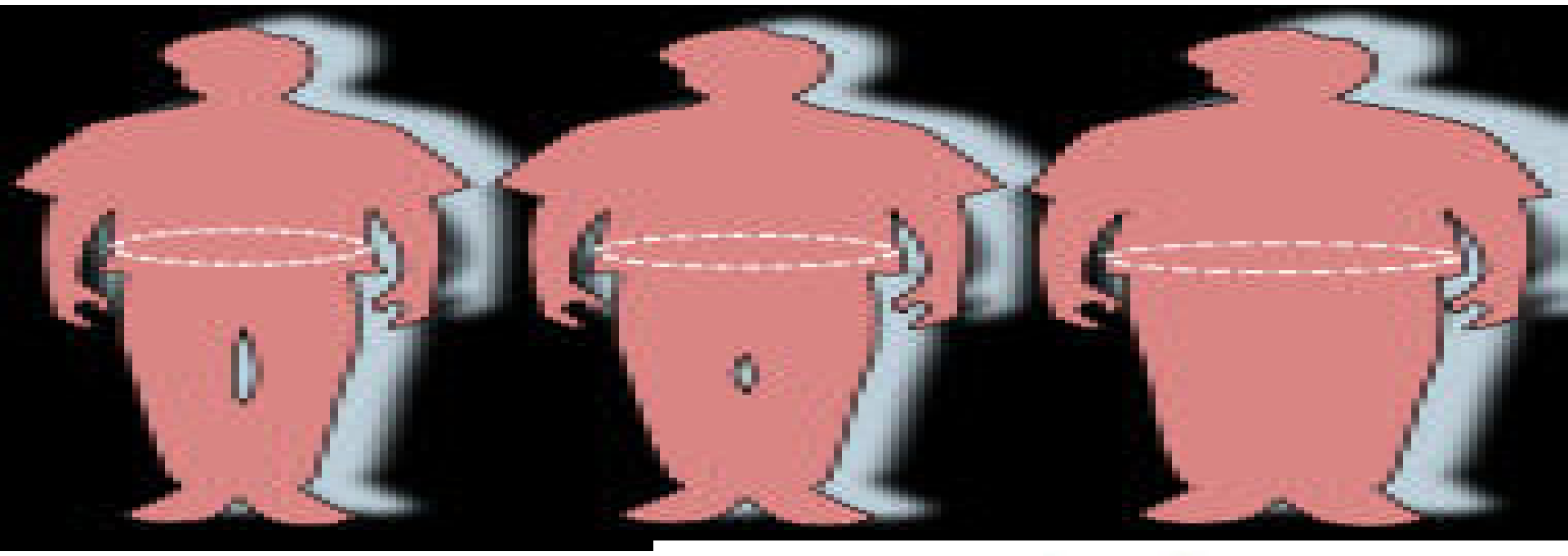


Upper Abdominal Obesity

- Increased abdominal circumference **(> 102 cm in men and 88 cm in women)**
- Waist to hip ratio **(> 1.0 for women and >0.8 for men)**

- **Visceral fat within abdominal cavity** is **more hazardous** to health than subcutaneous fat around abdomen
- Also called, **'Apple shaped obesity'**

- **Increased Risk** of diabetes mellitus, stroke, coronary artery disease, Cancer and early death



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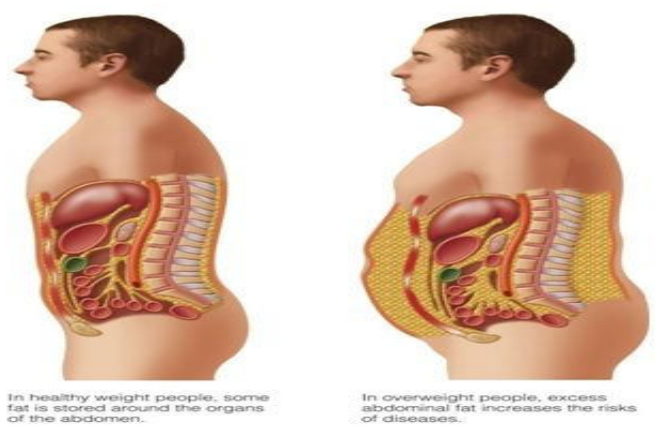


In healthy weight people, some fat is stored around the organs of the abdomen.

In overweight people, excess abdominal fat increases the risks of diseases.

Visceral vs Subcutaneous fat

Apple and Pear Body Shapes

central obesity is associated with increased risks of heart disease, stroke, diabetes, insulin resistance, hypertension, gallstones, and some types of cancer.

Lower-body fat is more common in women than in men and is not usually associated with chronic diseases.

Upper-body fat is more common in men than in women and is closely associated with heart disease, stroke, diabetes, hypertension, and some types of cancer.

Dr. Siham M.O.Gritly 51

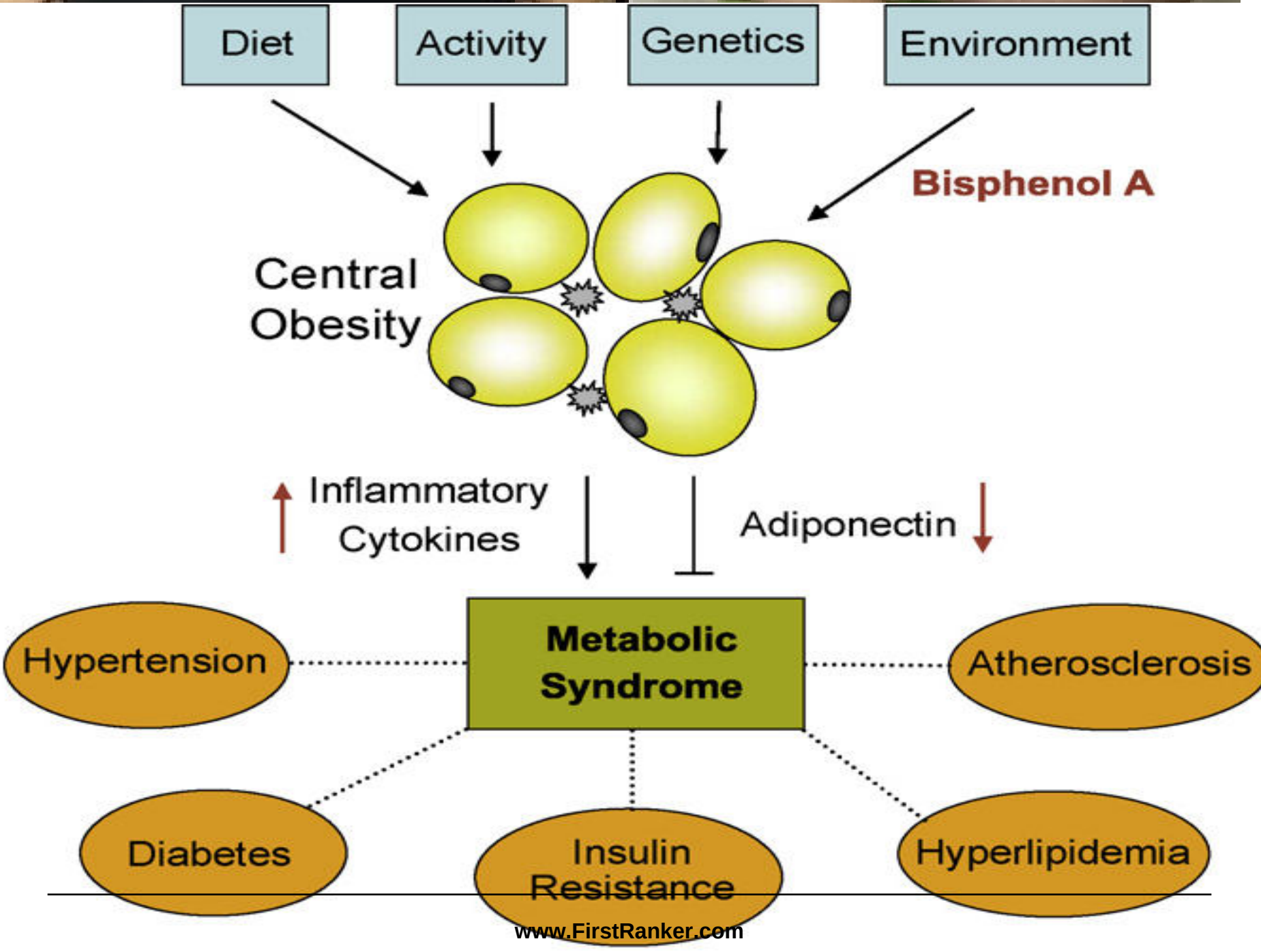
Complications of Obesity

Metabolic Syndrome Major Complication/Consequence Of Obesity

Metabolic Syndrome
X Syndrome

- **Affects Receptors** on Plasma membrane
- Protein Hormone Receptors altered
- Role of messengers for coordination and communication disturbed
- Dysregulation of Enzyme activity
- Affects over all Metabolism
- Insulin Resistance
- ~~Hyperlipoproteinemias~~

Central Obesity is Dreadful Increases Risk Of Metabolic Syndrome

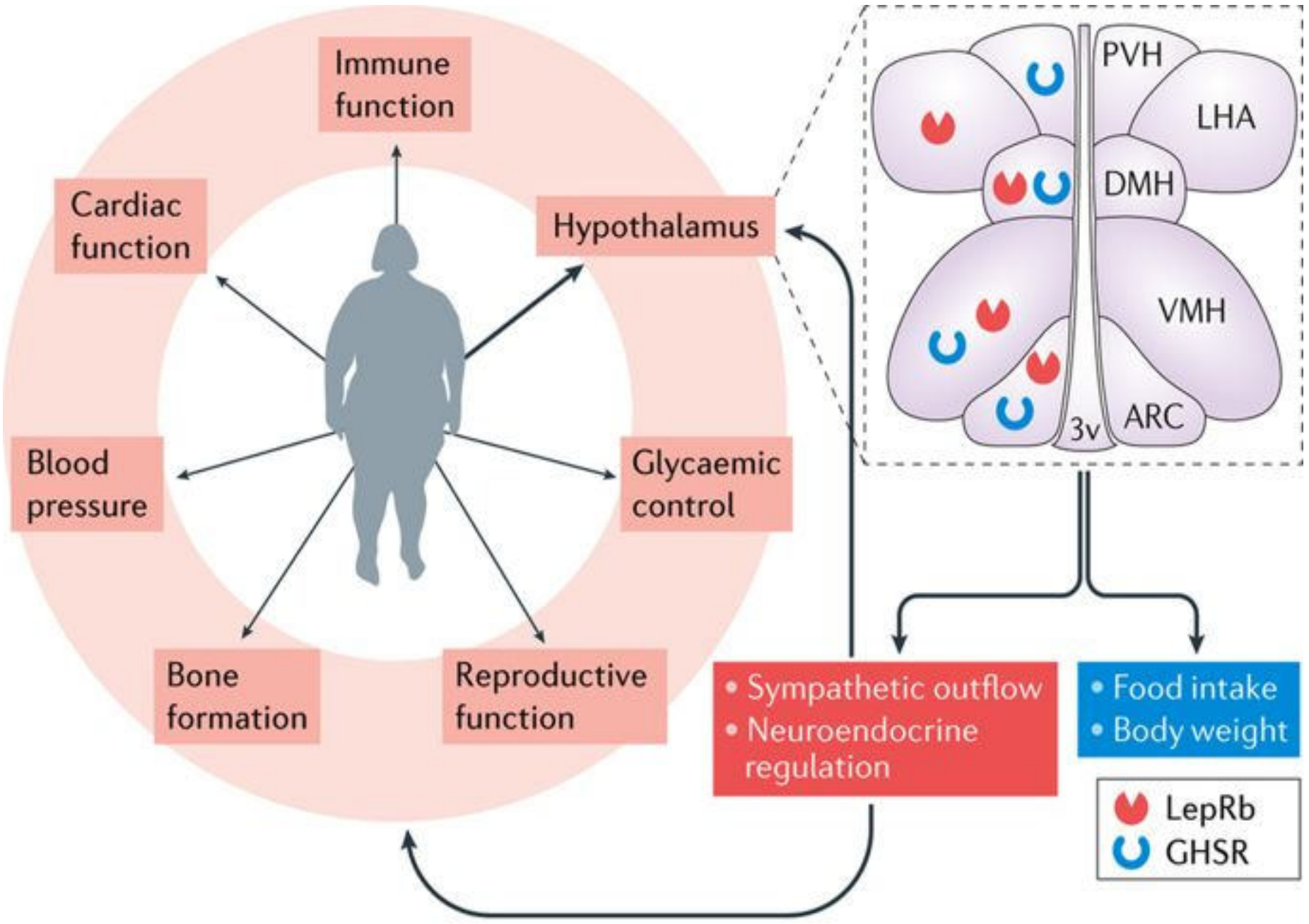


Disease risk from extra weight

Clinical Manifestations:

- Fine facial features on a heavy-looking stout child
- Larger upper arms & thighs
- Genu valgum common
- Relatively small hands & fingers tapering
- Adiposity in mammary regions

- Pendulous abdomen with Striate
- Psychologic disturbances common
- Bone age advanced
- In boys, external genitalia appear small though actually average in size
- In girls, external genitalia normal & menarche not delayed



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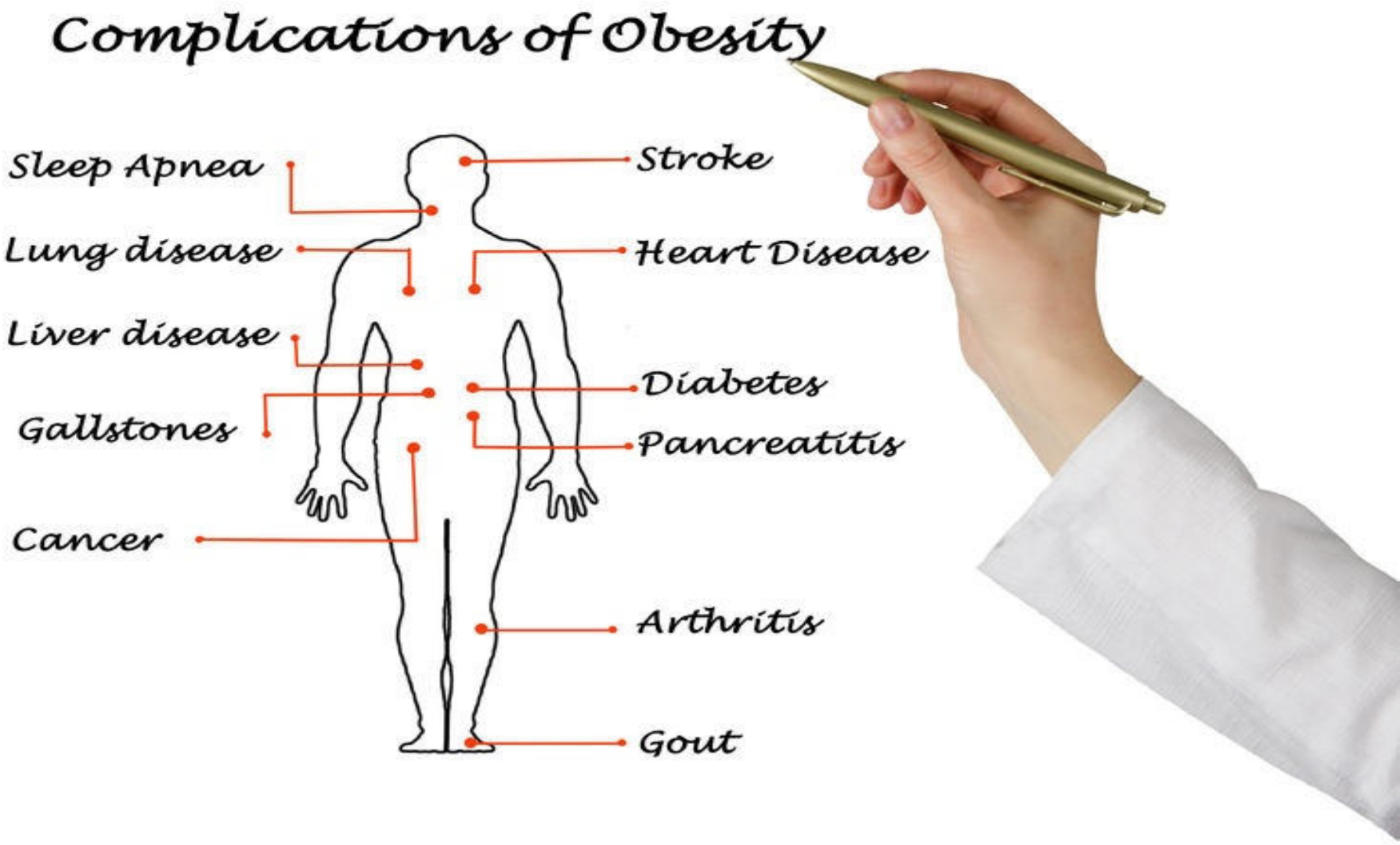
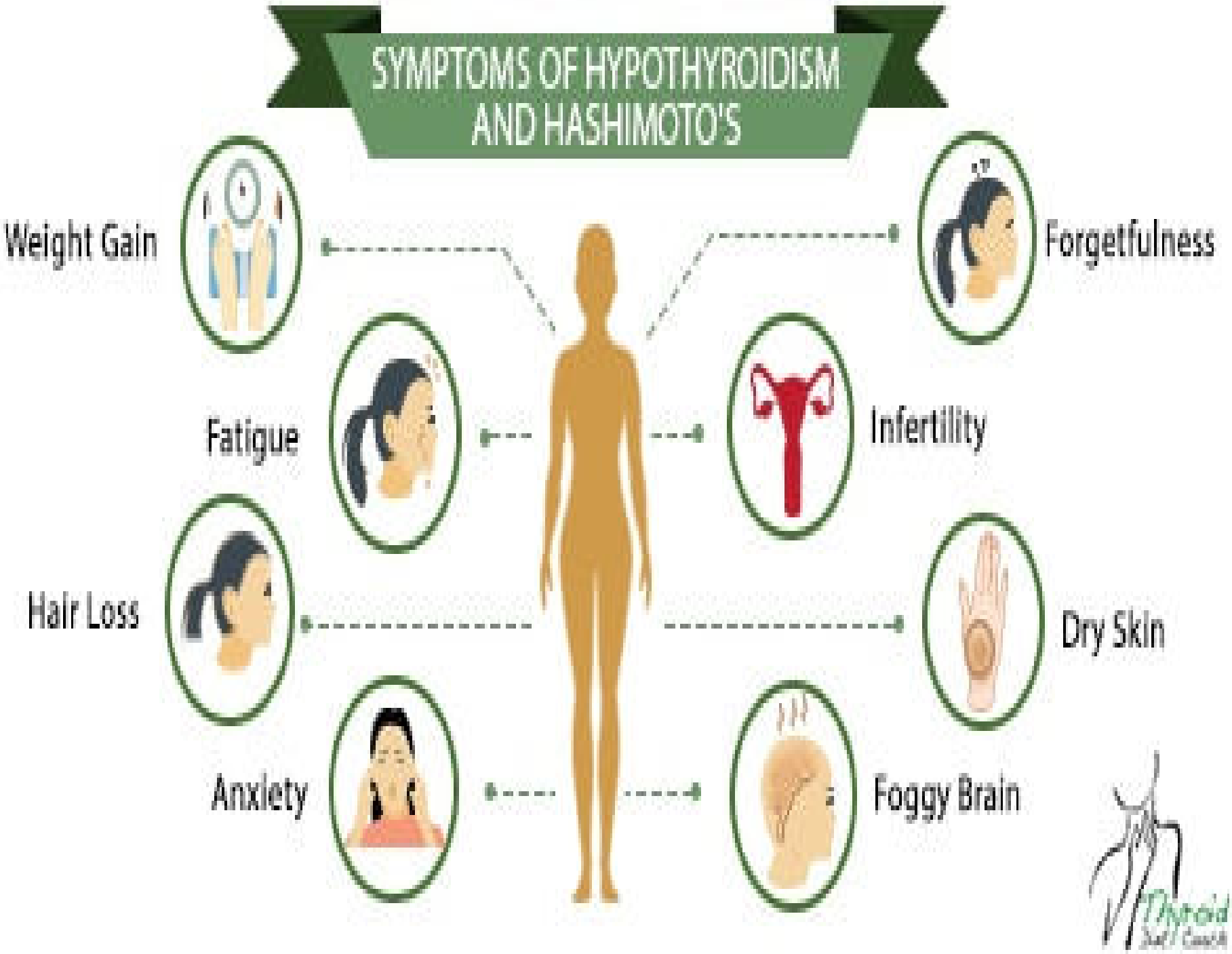
Obesity Affects Endocrine System



Obesity And Thyroid Dysfunction



Pickwickian Syndrome/
Obesity Hypoventilation Syndrome

- **Pickwickian syndrome** is a condition in which **severely overweight people**
- **Fail to breathe rapidly enough or deeply enough**
- Resulting in **low blood oxygen levels and high blood carbon dioxide (CO_2) levels**

- **Rare complication of extreme exogenous obesity**

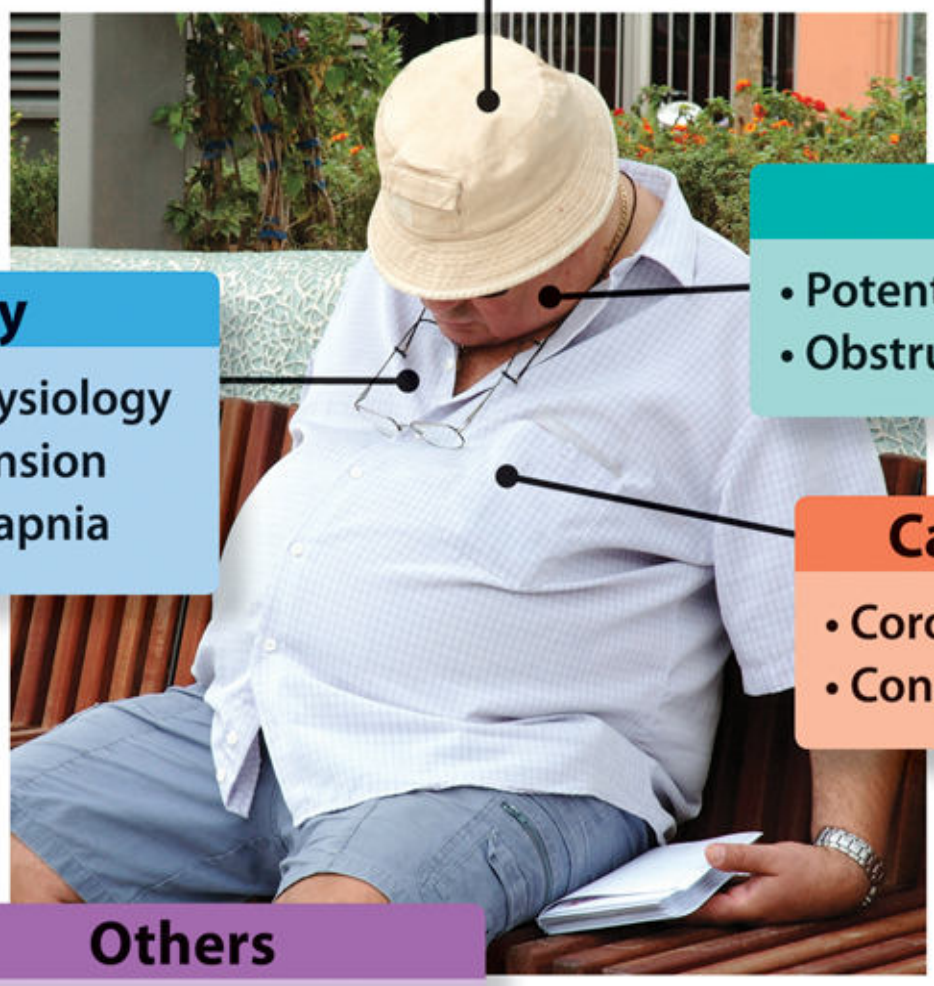
Signs And Symptoms

- ✓**Severe cardio respiratory distress & alveolar hypoventilation**
- ✓Includes polycythemia, hypoxemia, Cyanosis, CHF
- ✓Low Metabolic rate
- ✓Lethargic and Fatigue

- **Obesity Hypoventilation Syndrome have:**
  - –Concurrent obstructive sleep apnea, **a condition characterized by snoring**.
  - –**Interrupted sleep**
  - –**Excessive Daytime Sleepiness**

Central nervous system

- Decreased central respiratory drive



Airway

- Potential difficult airway
- Obstructive sleep apnea

Respiratory

- Restrictive chest physiology
- Pulmonary hypertension
- Hypoxemia/hypercapnia

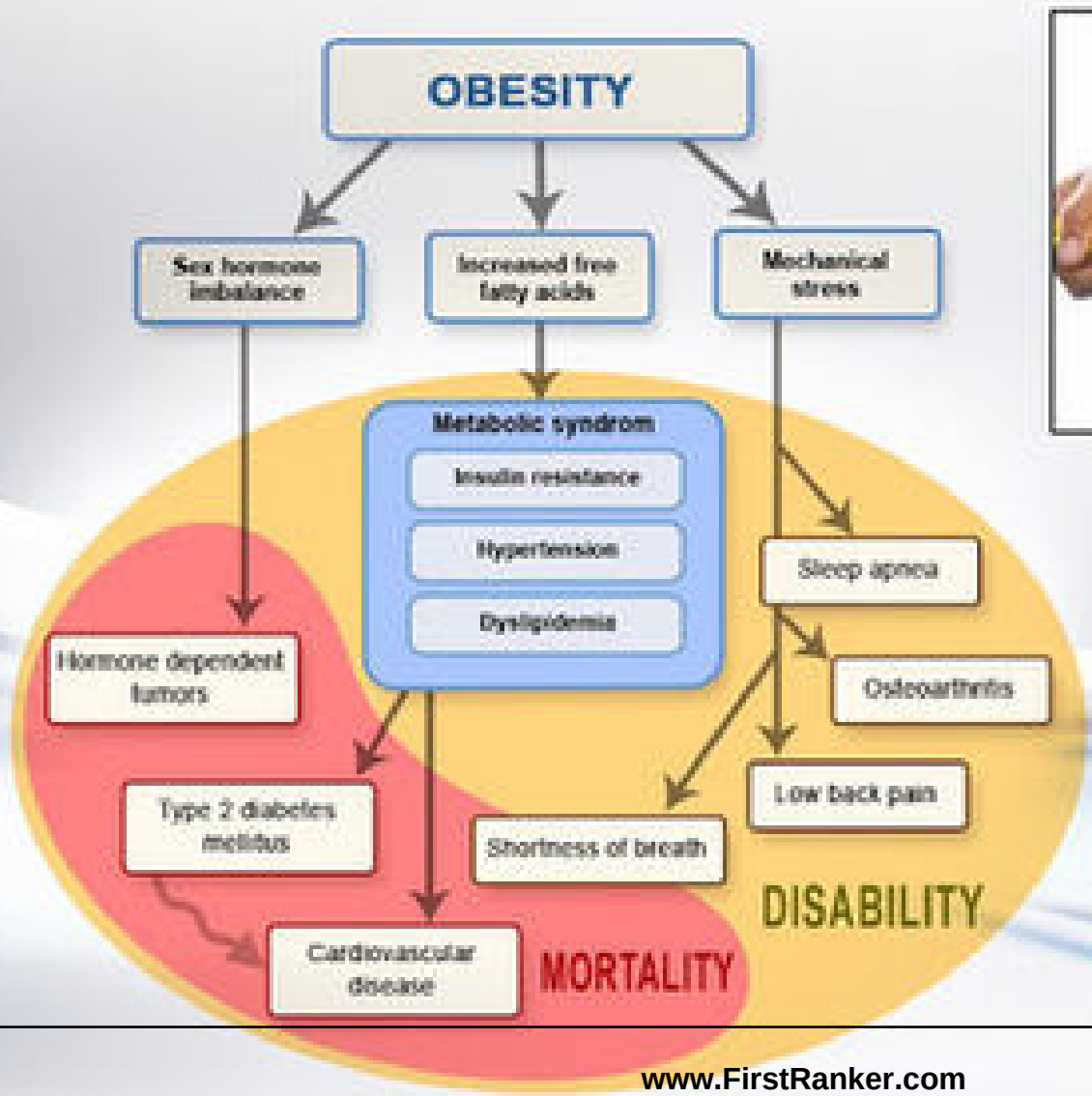
Cardiovascular

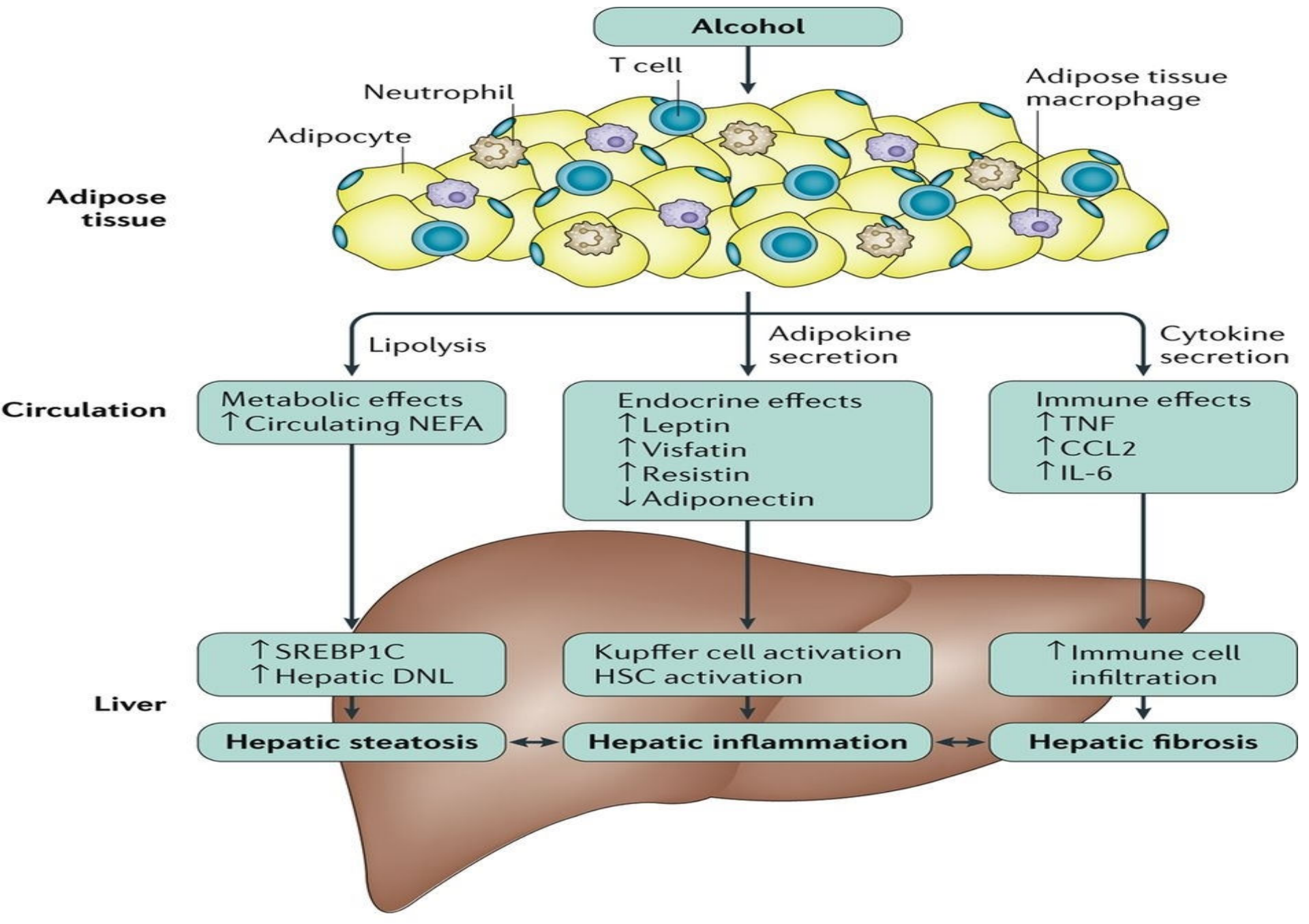
- Coronary artery disease
- Congestive heart failure

Others

- Difficult vascular access
- Difficult positioning

Effects of Overweight and Obesity





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Management Of Obesity

Treatment of Obesity

1st principle: Decrease energy intake

Initial medical exam to diagnose pathological causes

Plan right diet

a. Avoid all sweets, fried foods & fats

a. Limit milk- intake not >2 glasses/day

a. For 10-14 yrs, limit to 1100-1300 cal diet for several months

2nd principle: Increase energy output:

I. Obtain an activity history

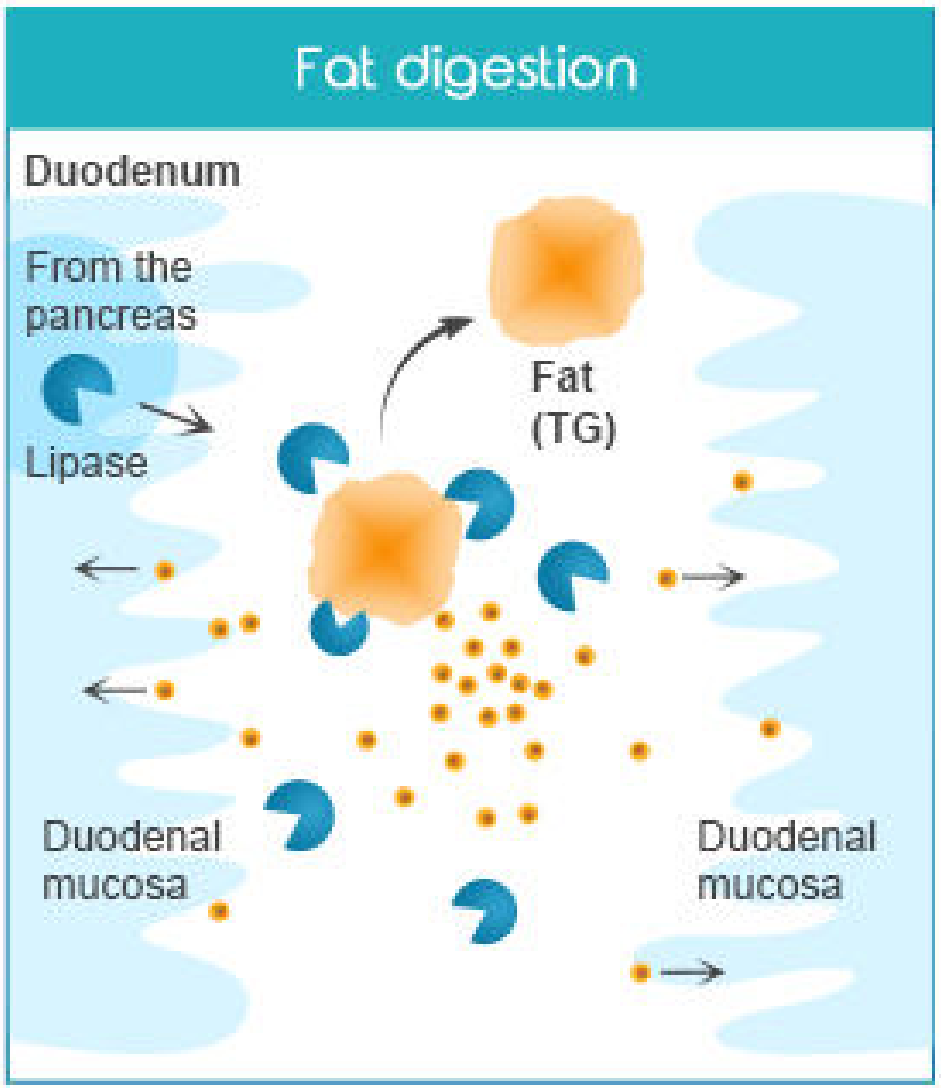
I. Increase physical activity

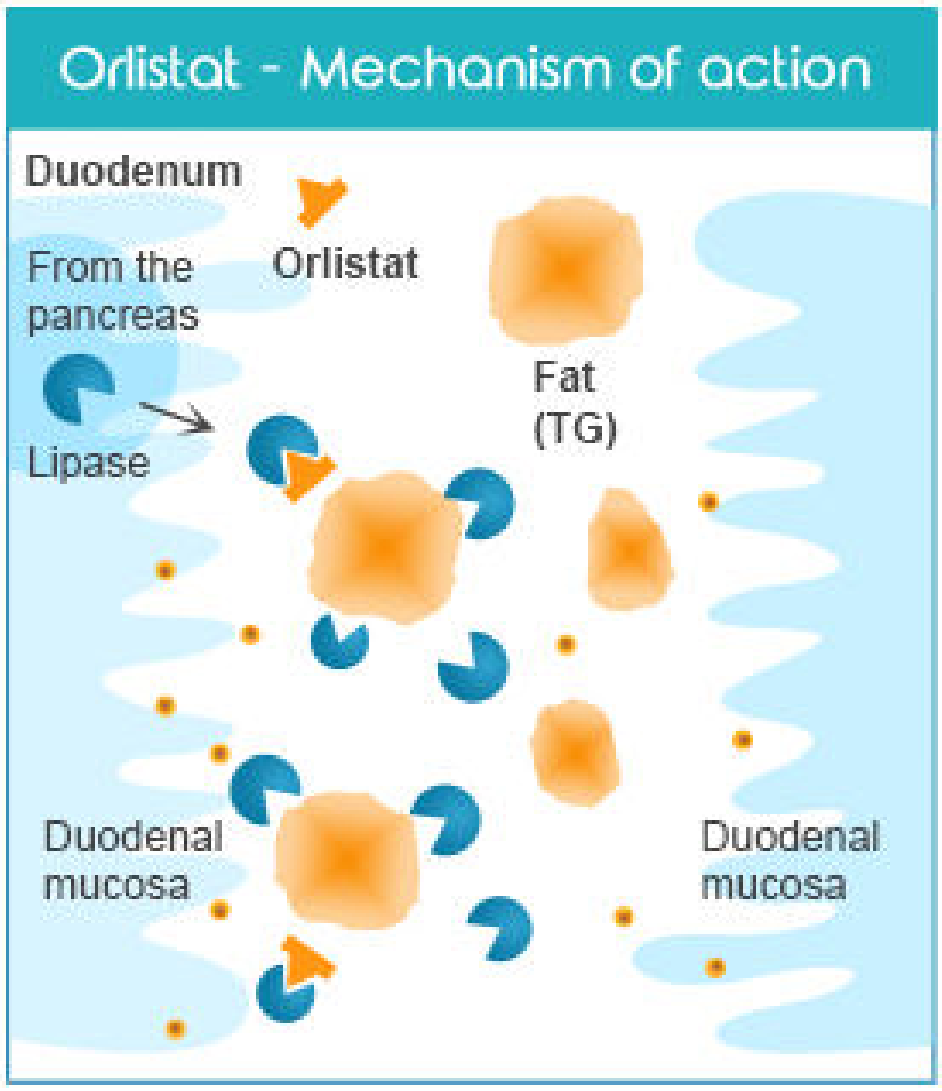
I. Involve in hobbies to prevent boredom

Advise To

- Stop Alcohol
- Cessation of Smoking

Orlistat FDA Approved Drug Inhibits Pancreatic Lipase ,TAG Digestion In GIT





Thoughtful and Rightful Knowledge Implementation Will Prevent Obesity

Over All Messages

Lets All Of Us Fight For Malnutrition

Eat Food Cautiously with Awareness

With Good Purpose Than Sensual Pleasure

Our Body Is Precious Gift
Health Is First Priority
THINK AND EAT
Cautiously,Moderately
Carefully and Rightly
Do Not Make Our Body As Dustbin

Eat As Follows

Sleep And Food Cycle Affects Health

Recommended Amount of Sleep for Pediatric Populations*

Age	Recommended Sleep Hours per 24 Hour Period
Infants: 4 to 12 months	12 to 16 hours (including naps)
Toddlers: 1 to 2 years	11 to 14 hours (including naps)
Preschoolers: 3 to 5 years	10 to 13 hours (including naps)
Gradeschoolers: 6 to 12 years	9 to 12 hours
Teens: 13 to 18 years	8 to 10 hours

*The American Academy of Pediatrics (AAP) has issued a Statement of Endorsement supporting these guidelines from the American Academy of Sleep Medicine (AASM).

Source: Paruthi S, Brooks LJ, D'Ambrosio C, Hall W, Kotagal S, Lloyd RM, Malow B,Maski K, Nichols C, Quan SF, Rosen CL, Troester MM, Wise MS. Recommended Amount of Sleep for Pediatric Populations: A Statement of the American Academy of Sleep Medicine. J Clin Sleep Med. 2016 May 25. pii: jc-00158-16. PubMed PMID: 27250809.

Change for Positivity

- **Adopt Do's**
- **Quit Don'ts**

Best For Human Health

Thoughtful and Rightful

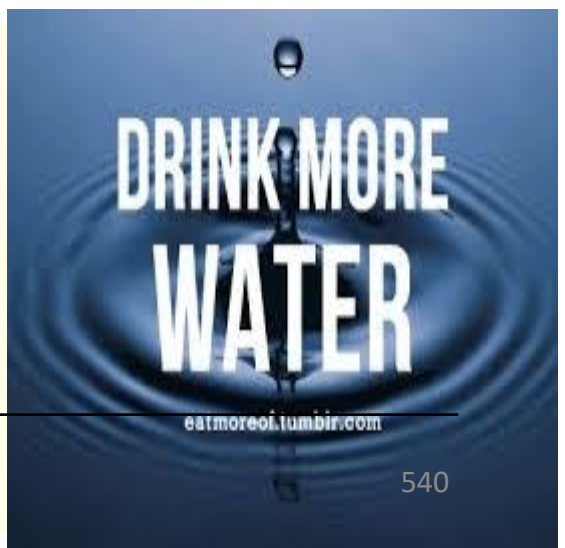
Eating And Living Style

Simple, Natural-

Planned ,Organized ,Regular, Disciplined

Simple , Humble, Care and Share

Yes for Good Stead Fast No For Bad



Questions

- **Short Notes**

- Food Groups ,their constituents and their role
- Basal Metabolic Rate (B.M.R.) & its importance.
- Calorific value of food and its calculations.
- Respiratory Quotient.(R.Q)
- Specific Dynamic Action (S.D.A.)
- Balanced diet
- Factors affecting BMR

- Biological value of Proteins.
- Nitrogen Balance & types.
- Role of Fiber in diet/Significance of dietary fibers.
- Protein Energy Malnutrition (PEM) /
- Differentiate between Kwashiorkor and Marasmus.
- Obesity: Causes and Consequences

THANKS