Unit 1

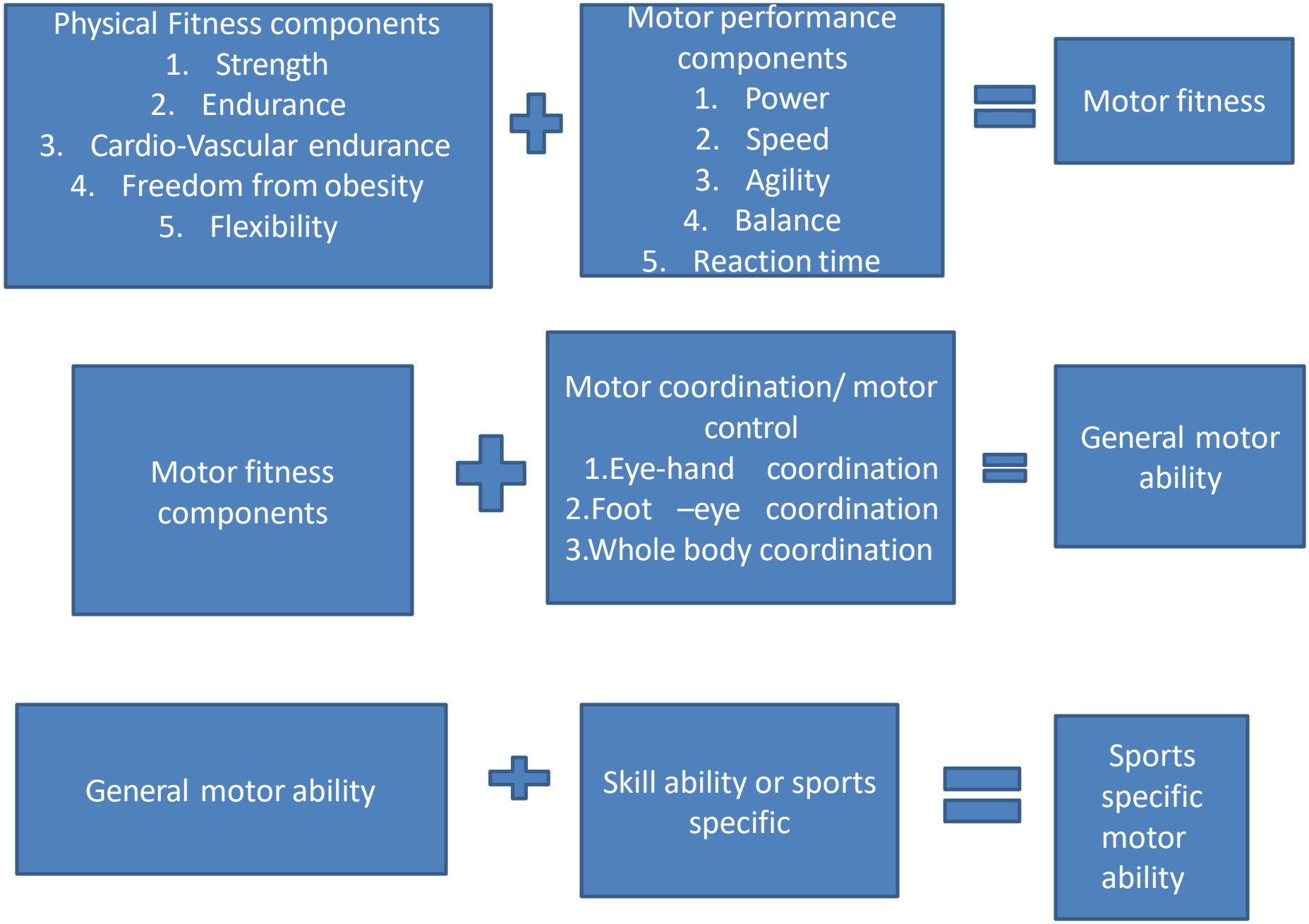
Motor Fitness and Diet

Objectives

- The main purpose of writing this chapter is to make the students understand the general concept of physical fitness, motor fitness, motor performance, general motor ability and sports-specific motor ability so that he/she is able to achieve the following objectives:
  - To understand the meaning and definitions of various components of fitness and motor ability.
  - To distinguish between physical fitness, motor fitness, general motor ability and sports specific ability.

Fitness and motor ability terms

- Organic fitness - Physical fitness
- Motor capacity - health related fitness
- Physical capacity - motor performance
- Psychomotor ability - motor fitness
- Athletic ability - general motor ability
- Motor educability - specific motor ability


Physical Fitness components
1. Strength
2. Endurance
3. Cardio-Vascular endurance
4. Freedom from obesity
5. Flexibility
Motor performance components
1. Power
2. Speed
3. Agility
4. Balance
5. Reaction time
Motor fitness
Motor fitness components
Motor coordination/ motor control
1.Eye-hand coordination
2.Foot –eye coordination
3.Whole body coordination
General motor ability
General motor ability
Skill ability or sports specific
Sports specific motor ability

What is physical fitness?

- Physical fitness is a general state of health and well-being and, more specifically, the ability to perform aspects of sports, occupations and daily activities.
- The World Health Organization (WHO) defined health in its constitution of 1948 as "*a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity*".
- Physical fitness is generally achieved through proper nutrition, moderate-vigorous physical exercise, and sufficient rest.

Components of Physical Fitness

- Refers to the several key components required to improve quality overall fitness.
- It has 5 key components

1. Muscular Strength-

Maximal contraction power of the muscles is known as Muscular strength.

Tested – Dynamometers /tensiometres.

Measured- - 1) JCR TEST

2)Roger's strength test.

2. Endurance(Stamina)-

The duration for which the muscles group may perform work maximally is known as muscular endurance.

It is the ability of body to process, deliver, store and utilize energy.

Measured--

1) Static Muscular endurance test
2) Bent Knee Sit Ups

3.Cardiovascular Endurance (Cardiopulmonary or circulatory respiratory)- The ability to perform muscular work at sub-maximal level by moderate contractions for a long time. It is measured with the help of long duration activities like running,swimming,cycling ,stepping.

Test- 1) Copper 12min run walk test.
2) Harvard step test.

4.Flexibility-

It refers to the range of motion in a joint or a group of joints during a passive movement.

TEST- 1) Sit and reach test
2) Bridge-up test.

5.Body Composition(Freedom from obesity)-

It is used to describe the percentages of fat, bone, water and muscle in human bodies.

Components of Motor Performance

- 1) POWER
- 2)AGILITY
- 3)BALANCE
- 4)SPEED
- 5)REACTION TIME

Components

- Power- It is ones ability to produce maximum muscular force in shortest time.In other words power means ones capacity of work output per unit of time.
- Power is of two types--
- Athletic power-Sargent jump , Broad jump
- Work power- Anaerobic power test
- Agility-Ones controlled ability to change body position and direction rapidly and accurately.
- Mesurements of Agility-1)Shuttle run test
  2) Burpee test.

Components

- Balance – Ones ability to maintain the body's centre of gravity over the centre of supporting base of the body.
  - Types
  - 1)Static
  - 2)Dynamic
  - Measurement-Bass stick test, Stork stand test.

  Speed-Ones ability to perform successive movement of the same pattern at the fast rate.

  Measurement- Sprint test(50yd,40yd)

  Second test.

Reaction time

- The interval of time between the presentation of stimulus and the starting of response.

- Measurement- Nelson Hand reaction time test
- Nelson Foot reaction time test

What is motor fitness?

- Motor Fitness refers to the ability of an athlete to perform successfully at their sport.

- Fitness is the ability to meet the demands of a physical task.

Motor fitness components

Physical Fitness Components

1.Muscular strength
2.Muscular Endurance
3.Cardio Vascular Endurance
4.Freedom From Obesity
5.Flexibility

Motor Performance Components

1.Power
2.Speed
3.Agility
4.Balance
5.Reaction Time

Physical Fitness Components + Motor Performance Components

=

Motor Fitness

General motor ability

- It may be defined as motor fitness including neuro-muscular coordination abilities or motor control by eye-hand coordination, eye-foot coordination and whole body movement coordination.
- When we use the term general motor ability ,we are talking about basic motor fitness and general body coordination skills needed in various sports,athletics and gymnastic activities.

Sports specifc motor ability(sports skills)

- It may be defined as general motor ability plus excellence in specific sports skill in the game of ones specialization.
- Thus sport specific motor ability is the reference of all fitness ,skill ability and motor control.

Balanced Diet

1. A diet that contains the proper proportions of carbohydrates, fats, proteins, vitamins, minerals, and water necessary to maintain good health.

2. A diet consisting of the proper quantities and proportions of foods needed to maintain health or growth.
   Our diet must consist of approximately-
   Carbohydrates = 57% (Sugar, Sweets etc.)
   Fat = 30% (Dairy products, oil etc.)
   Proteins = 13% (Eggs, milk, meat etc.)

Nutrient Balance

- Carbohydrates- These are the main source of energy in our body.
- Proteins- Help in growth and repairing of tissues.
- Fats- Help to provide energy and for fat soluble vitamins.
- Vitamins- Vitamins allow your body to grow and develop. They also play important roles in bodily functions.
- Minerals- They are important for building strong bones and metabolic processes such as those that turn the food we eat into energy.
- Water- It helps in transportation of various nutrients in the body.

Daily Energy Requirements

1. **Basic Energy Requirements-**

We need 1.3 calories per hour per kg of our weight.

Daily Basic Energy Requirement= 1.3 x 24 x Weight(in kgs)

2. **Extra Energy Requirements-**

We need extra 8.5 calories per 2 hours per kg of our weight during sports activities.

Extra Energy Requirement= 8.5 x Time(in hrs) x Weight(in kgs)

Food intake and Competition

1. **Food intake a week before competition**

   Take more of carbohydrates so that we don't feel deficiency of energy during the competition. Decrease the quantity of fat. Also a little amount of proteins

2. **Eating before competition**

   A lots of carbohydrates, and very low amount of fats, proteins, fibers.

3. **Pre-Competition Meal**

   Eat a lots of liquid food rich in carbohydrates and lots of fruits to increase your energy reserves.

4. Eating just before competition

A little amount of carbohydrate rich food (approx. 50 gms) helps you to ease out your nervousness before competition.

5. Eating or Drinking during Competition

Intake carbohydrates at regular spells in very short spells. Drink something at least 15-20 seconds before the match, and drink water in every 15 minutes interval during the match.

Special Considerations

Before the competition, avoid intake a large amount of fats, proteins, minerals, i.e. everything other than carbohydrates and water.

Sources of Nutrients

Carbohydates	Fats	Protein
1. All type of cereals. 2. potatoes; corn; fruits; vegetables, small quantity is found in all the type of food.	1. Dairy products 2. Cooking and meat fats. 3. Egg, etc	1. All type of meat 2. Pulses 3. Milk, etc

VITAMINS NAME	DEFICIENCY/DISEASE	MAIN SOURCE
A	Night blindness, low testosterone levels	LIVER AND FISH OIL, GREEN VEGETABLES,MILK,CARRO
B1	BERI BERI	Whole grains, cereals, and beans
B2	Cracking of skin	MILK AND PEAS
B12	Anemia	Fish ,maet ,egg, milk
C	SCURVY	citrus **fruits**
D	RICKETS AND IMMUNE SYSTEM	Sun, dairy products, orange juice, soy **milk**, and cereals
E K	nervous disorders BLOOD	Nuts Green leafy vegetables

Male		Female	
Height	Ideal Weight	Height	Ideal Weight
4' 6"	28 - 35 Kg.	4' 6"	28 - 35 Kg.
4' 7"	30 - 39 Kg.	4' 7"	30 - 37 Kg.
4' 8"	33 - 40 Kg.	4' 8"	32 - 40 Kg.
4' 9"	35 - 44 Kg.	4' 9"	35 - 42 Kg.
4' 10"	38 - 46 Kg.	4' 10"	36 - 45 Kg.
4' 11"	40 - 50 Kg.	4' 11"	39 - 47 Kg.
5' 0"	43 - 53 Kg.	5' 0"	40 - 50 Kg.
5' 1"	45 - 55 Kg.	5' 1"	43 - 52 Kg.
5' 2"	48 - 59 Kg.	5' 2"	45 - 55 Kg.
5' 3"	50 - 61 Kg.	5' 3"	47 - 57 Kg.
5' 4"	53 - 65 Kg.	5' 4"	49 - 60 Kg.
5' 5"	55 - 68 Kg.	5' 5"	51 - 62 Kg.
5' 6"	58 - 70 Kg.	5' 6"	53 - 65 Kg.
5' 7"	60 - 74 Kg.	5' 7"	55 - 67 Kg.
5' 8"	63 - 76 Kg.	5' 8"	57 - 70 Kg.
5' 9"	65 - 80 Kg.	5' 9"	59 - 72 Kg.
5' 10"	67 - 83 Kg.	5' 10"	61 - 75 Kg.
5' 11"	70 - 85 Kg.	5' 11"	63 - 77 Kg.
6' 0"	72 - 89 Kg.	6' 0"	65 - 80 Kg.

Human Skeleton System

-The **human skeleton** is the internal framework of the body.

-The adult human **skeletal system** consists of 206 bones, as well as a network of tendons, ligaments and cartilage that connects them.

-The **skeletal system** performs vital functions — support, movement, protection, blood cell production, calcium storage and endocrine regulation — that enable us to survive.

-The human skeleton can be divided into two parts

1. Axial skeleton (80 bones)
2. Appendicular skeleton. (126 bones)

Axial Skeleton

-80 bones are found in axial skeleton

3 Parts of Axial Skeleton

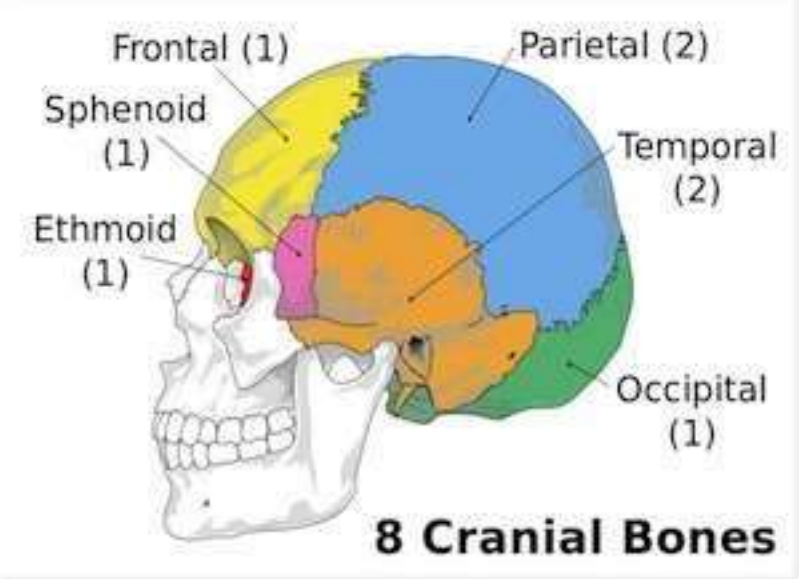
1. Skull (28 bones)
2. Rib Cage(25 bones)
3. Vertebral Column(27 bones)

28+25+27 = 80

1. Skull – a) Cranium (8 bones)
b) Face (14 bones)
c) Ear (6 bones)

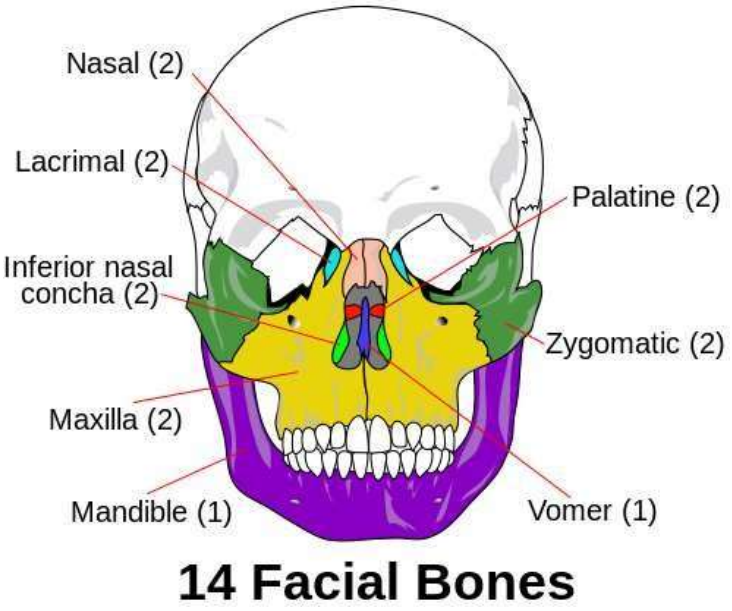
Cranium-(8 bones)

1 x Frontal Bone
1 x Occipital Bone
2 x Parietal Bones
1 x Sphenoid Bone
2 x Temporal Bones
1 x Ethmoid Bone



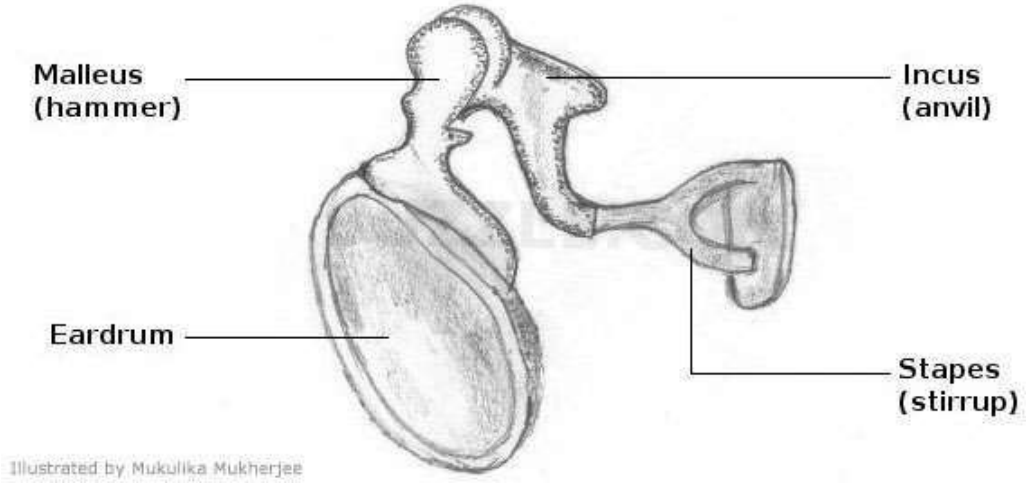
Face – (14 bones)

2 x Inferior Nasal Conchae
2 x Lacrimal Bones
1 x Mandible
2 x Maxillae (pl.); Maxilla (sing.)
2 x Nasal Bones
2 x Palatine Bones
1 x Vomer
2 x Zygomatic Bones



Ear – (6 bones)

2 x Malleus
2 x Incus
2 x Stapes

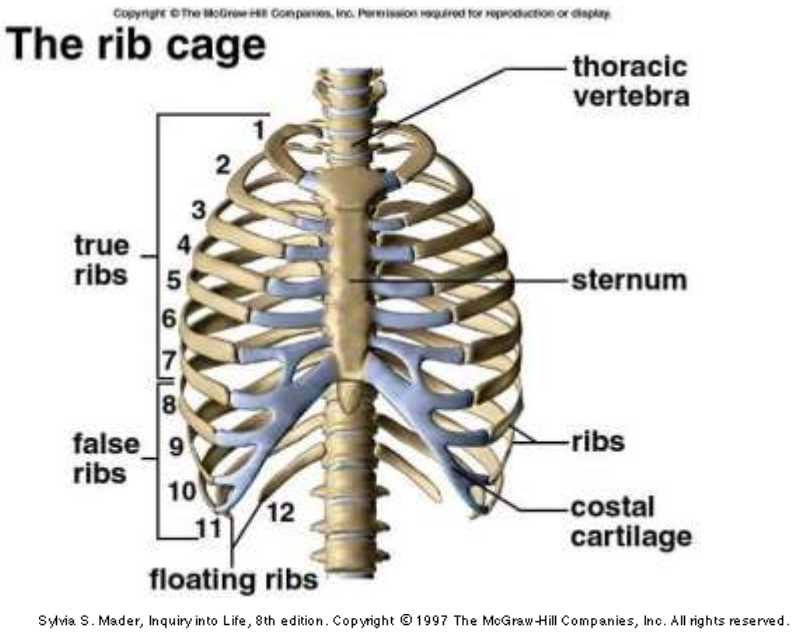


2. Rib Cage (25 bones)

a) Sternum – 1

b) True Ribs – 7 pairs = 14

c) False Ribs -5 pairs = 10



3. Vertebral Column (27 bones)

a) Cervical Vertebrae -7

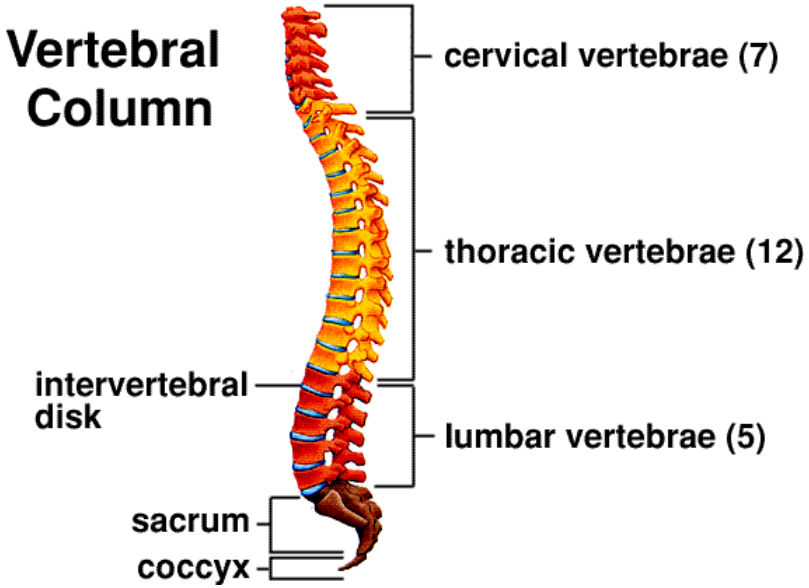
b) Thoracic Vertebrae - 12

c) Lumbar vertebrae – 5

d) Sacrum - 1

e) Coccyx – 1

f) Hyoid -1



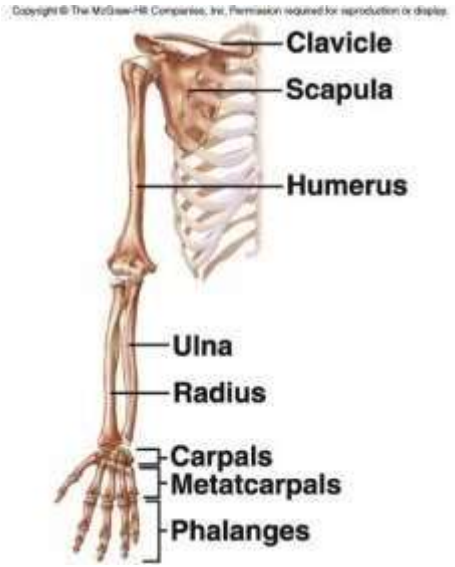
Appendicular Skeleton

1. Upper Extremities (64 bones)
2. Lower Extremities (62 bones)

64+62 = 126 bones

1. Upper Extremities (64 bones)

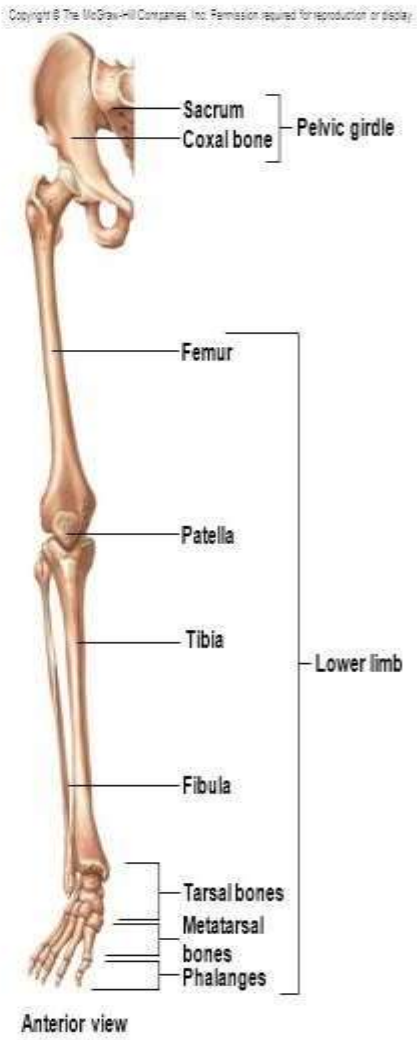
a) Clavicle – 2
b) Scapula – 2
c) Humerus – 2
d) Radius – 2
e) Ulna – 2
f) Carpal – 16
g) Metacarpals – 10
h) Phalanges - 28



2. Lower Extrematies (62 bones)

a) Pelvic -2
b) Femur – 2
c) Patella – 2
d) Tibia – 2
e) Fibulla -2
f) Tarsal – 14
g) Metatarsal – 10
h) Phalenges - 28

Fig. 6.29



Joint

A point where two bones meet in the body.

A joint is the connection made between bones in the body.

Types of Joint :

a) Hinge -

b) Pivot -

c) Ball and Socket -

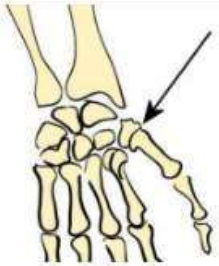
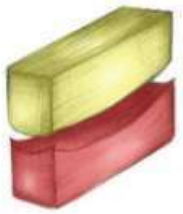
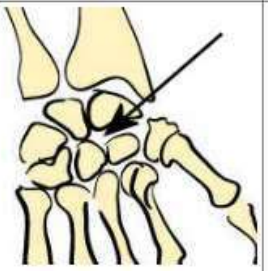
d) Gliding -

e) Saddle -

f) Condile -

Joint Type	Movement at joint	Examples	Structure
Hinge	Flexion/Extension	 Elbow/Knee	 Hinge joint
Pivot	Rotation of one bone around another	 Top of the neck (atlas and axis bones)	 Pivot Joint
Ball and Socket	Flexion/Extension/Adduction/ Abduction/Internal & External Rotation	 Shoulder/Hip	 Ball and socket joint

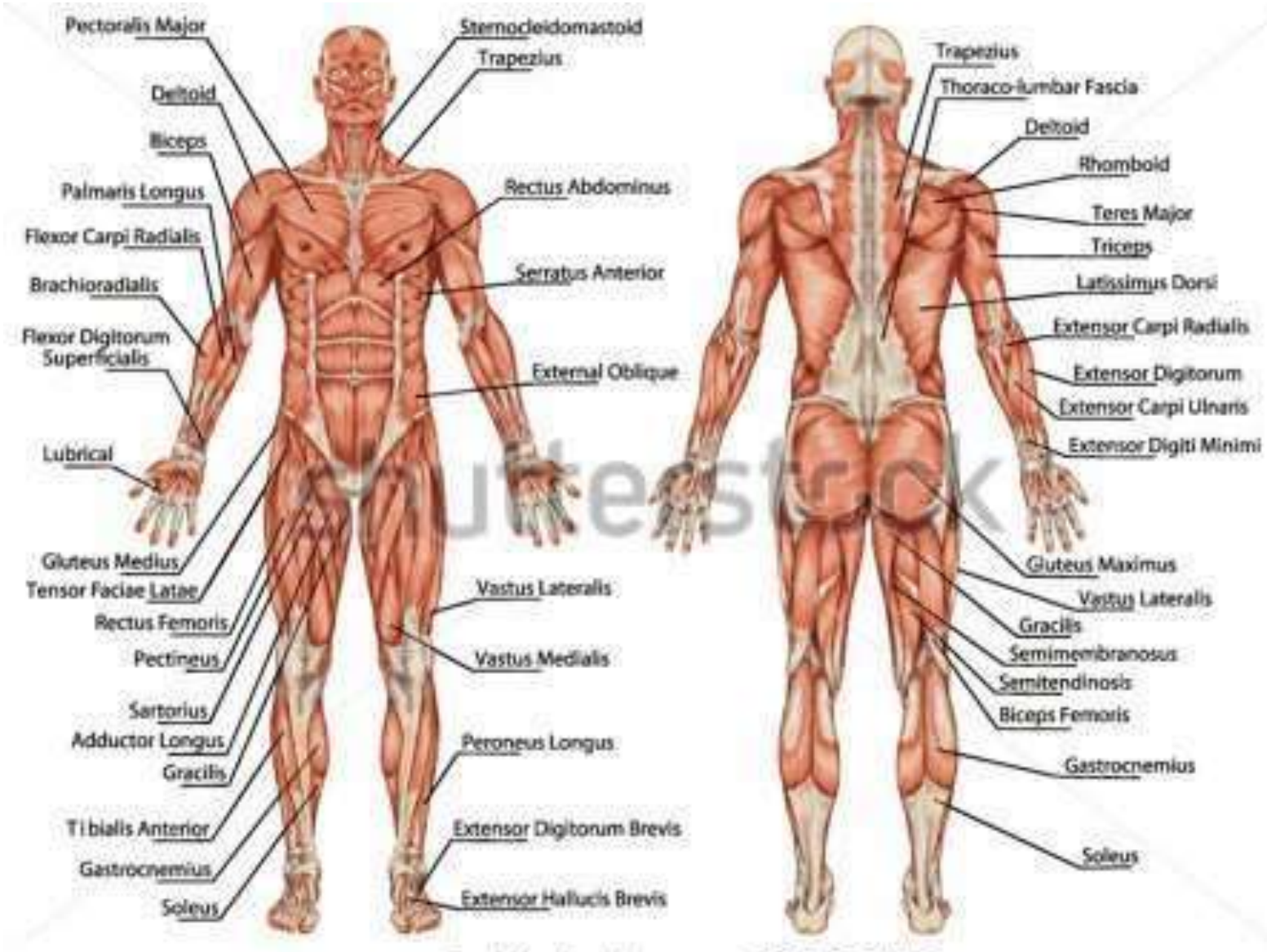
1 – Shoulder – Ball and Socket
2 – Elbow – Hinge
3 Pelvic – Ball and Socket
4 Knee – Hinge
5 Neck – Pivot
6 Ankle – Hinge and Gliding
7 Wrist – Saddle and Condile
8 Carpal – Gliding
9 Tarsal - Gliding

Saddle	Flexion/Extension/Adduction/ Abduction/Circumduction	 CMC joint of the thumb	 Saddle joint
Condyloid	Flexion/Extension/Adduction/ Abduction/Circumduction	 Wrist/MCP & MTP joints	 Condyloid joint
Gliding	Gliding movements	 Intercarpal joints	 Gliding joint

MUSCULAR SYSTEM

Without muscle, humans could not live. The primary job of muscle is to move the bones of the skeleton. There are more than 650 individual muscles in human body. These constitute about 40 % of average human weight.

Muscular System



Types of Muscle

- Skeletal Muscle : Skeletal muscles are also sometimes called voluntary muscles, because we have direct control over them. Skeletal Muscles are those which attach to bones and have the main function of contracting to facilitate movement of our skeletons. They are also sometimes known as striated muscles.

- Smooth muscle : Smooth muscle is also sometimes known as Involuntary muscle due to our inability to control its movements, or Unstriated as it does not have the stripy appearance of Skeletal muscle. Smooth muscle is found in the walls of hollow organs such as the Stomach and internal organs.

- Cardiac Muscle : This type of muscle is found solely in the walls of the heart. It has similarities with skeletal muscles in that it is striated and with smooth muscles in that its contractions are not under conscious control

Muscle Contraction

Muscle contractions are classified according to the movements they cause and in fitness we are primarily concerned with the following three types of contraction:

1. **Isotonic /Dynamic Contraction:** There are two types of **isotonic contractions**:
   a) **Concentric contraction**: Any contraction where the muscle shortens under load or tension
   b) **Eccentric contraction**: Muscles not only 'shorten' but can also lengthen under load or tension. An eccentric contraction refers to any contraction where the muscle lengthens under load or tension. is known as a concentric contraction

1. **Isometric /Static Contraction:** exercise or isometrics are a type of strength training in which the joint angle and muscle length do not change during **contraction. Example:** Pushing the wall.
2. **Isokinetic Contraction:** The defining characteristic of **this** muscle **contractions** is that they result in movements of a constant speed.

Hypertrophy of Muscles

An increase in size of skeletal muscle through a growth in size of its component cells.

ROLE OF MUSCLES

Muscles role are of 4 types in any movement:

- Agonist (Mover) role: To generate movement
- Antagonist Role: Opposite to Agonist Role
- Stabilizer (Fixator) role
- Neutralizer Role

Agonist (Mover) role: a muscle or group of muscles that causes the motion

- Without this muscle the motion is no longer possible
- The muscle contracts isotonically to produce a motion or isometrically to maintain a position
- Example: The quadriceps, through concentric isotonic contraction, is the primary muscle responsible for knee extension.

Stabilizer (Fixator) role- the muscle may contract to hold a body part immobile while another body part is moving. The sustained stabilizing contraction is frequently isometric.

- Example: To perform isolated elbow flexion the proximal shoulder joint must be stabilized by muscles.

Antagonist - performs the opposite motion of the prime mover

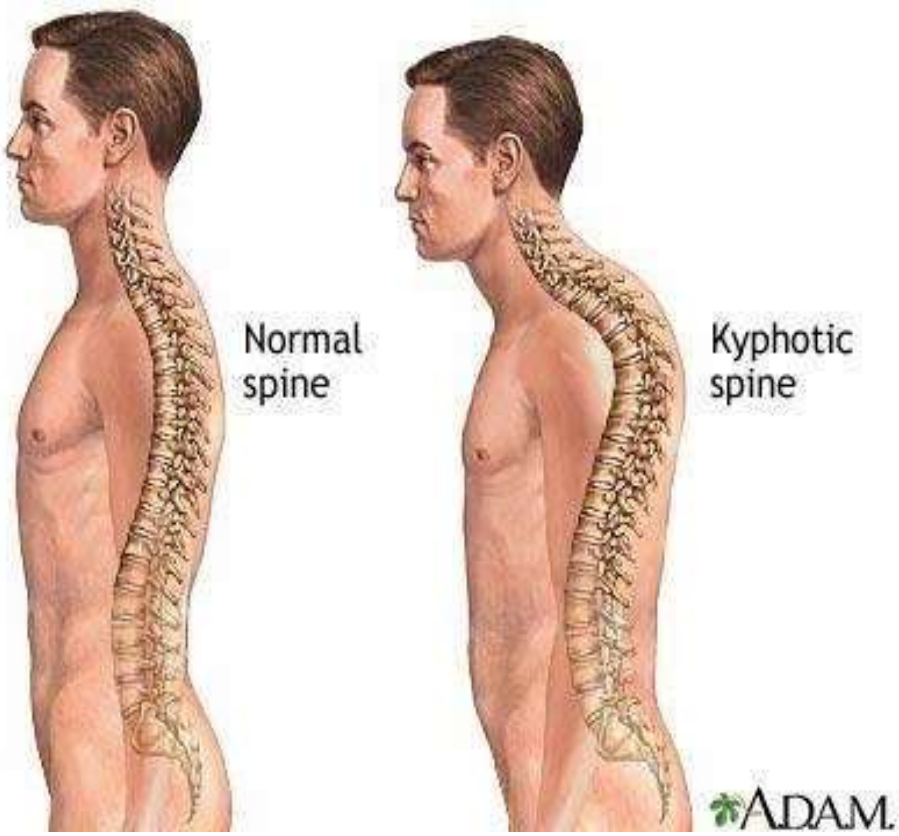
- It contracts eccentrically or "relaxes" and expands to prevent, slow or control a motion.
- Example: In elbow extension, the triceps would be the agonist and the biceps would be the antagonist. With elbow flexion, the biceps would be the agonist and the triceps would be the antagonist
- It is an important part of neuromuscular coordination.

Neutralizer - prevents unwanted motions a muscle can perform so a specific motion can occur. Mostly dependant on the angle of pull.

- Stabilizers are associated with joints; Neutralizers are associated with muscle.

POSTURAL DEFORMITIES

KYPHOSIS



KYPHOSIS

- **Kyphosis** also called **round back** , is a condition of over-curve of the upper back. It can be either the result of degenerative diseases , developmental problems, osteoporosis with compression fractures of the vertebrae, and/or trauma.

CAUSES

- Habitual Bad Posture
- Underdevelopment/ Weakness of Longitudinal Back Muscle
- Rickets
- Mental/Physical Fatigue
- Injury/Disease of Spine

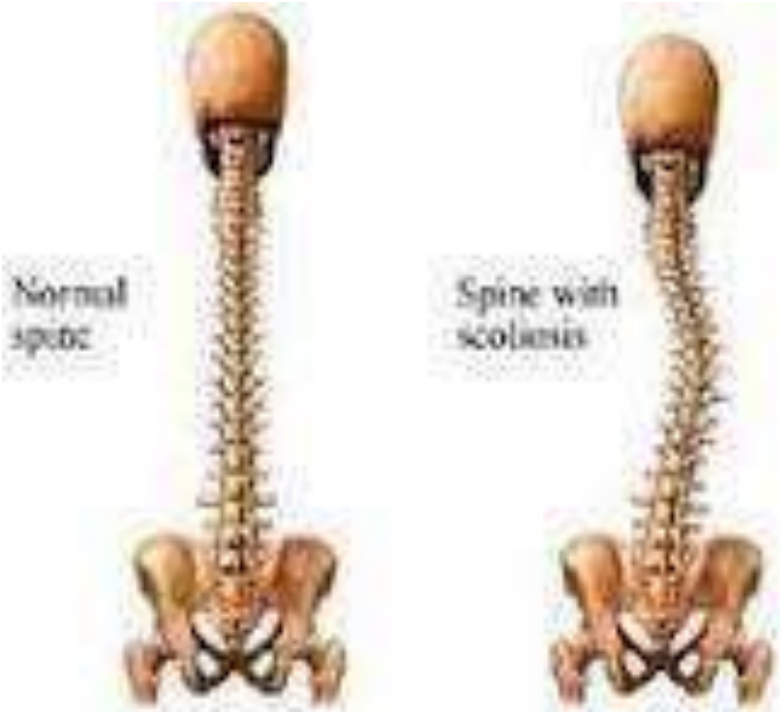
SYMPTOMS

- Appearance of poor posture, back pain, muscle fatigue, and stiffness in the back.
- In rare cases, this can lead to compression of the spinal cord with neurologic symptoms including weakness, loss of sense, or loss of bladder control.
- Thoracic kyphosis can also limit the amount of space in the chest and cause cardiac and pulmonary problems leading to chest pain and shortness of breath.

REMEDIAL EXERCISE

- **Mobilizing exercises** are given for whole spine.
- **Strengthening exercises** are given for abdominal muscles and back extensors.
- There may be associated tightening in hamstring muscles. So **stretching of hamstring** is done.

SCOLIOSIS


Normal spine
Spine with scoliosis
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SCOLIOSIS

Scoliosis is an abnormal curving of the spine. Your spine is your backbone. It runs straight down your back. Everyone's spine naturally curves a bit. But people with scoliosis have a spine that curves too much. The spine might look like the letter "C" or "S."

Causes

In most cases (85%), the cause of scoliosis is unknown . The other 15% of cases fall into two groups:

- Functional: This type of scoliosis is a temporary condition when the spine is otherwise normal.. Examples include one leg being shorter than another from muscle spasms .
- Structural: In this type of scoliosis, the spine is not normal. The curve is caused by another disease process such as a birth defect, metabolic diseases, connective tissue disorders.

SYMPTOMS

- One shoulder is higher than the other
- One shoulder blade sticks out more than the other
- One side of the rib cage appears higher than the other
- One hip appears higher or more prominent than the other
- The waist appears uneven
- The body tilts to one side
- One leg may appear shorter than the other

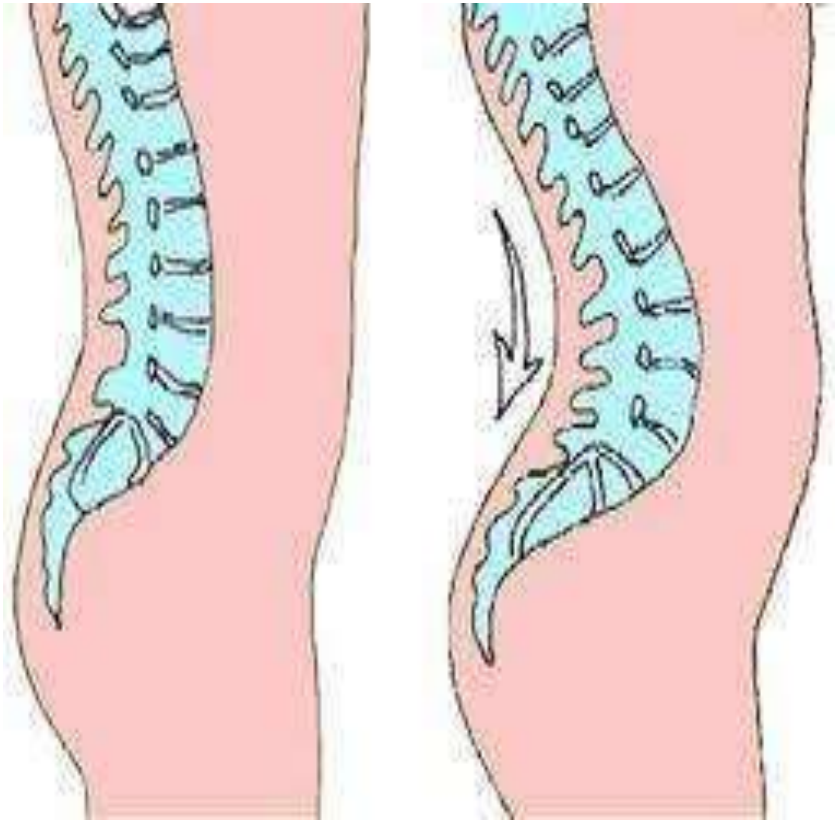
Remedial Treatment

1.Surgery

2.Strengthing Back Muscles

3.Exercise for back.

LORDOSIS



LORDOSIS

Lordosis is a medical term used to describe an inward curve of a portion of the lumbar vertebral column.

Excessive or hyper lordosis is commonly referred to as **swayback** or **saddle back**.

CAUSES

- Imbalances in muscle strength and length are also a cause, such as weak hamstrings, or tight hip.
- Tight low back muscles.
- Excessive fat.

TREATMENT

- **Physical Therapy-** Exercises may be used to strengthen muscles and increase range of motion. You may also be informed how to maintain a correct posture.
- **Development of abdominal muscles.**
- **Inclined Exercise.**
- **Surgery.**

BOW- LEG

Bowlegs is a condition in which the knees stay wide apart when a person stands with the feet and ankles together.

CAUSES

Bowlegs may be caused by illnesses such as:

- Abnormal development of bone
- Fractures that do not heal correctly
- Lead or flouride excess in water
- Rickets, which is caused by a vitamin D deficiency.

SYMPTOMS

- Knees do not touch when standing with feet together (ankles touching)
- Bowing of legs is same on both side of the body
- Bowed legs continue beyond age 3

TREATMENT

- If the condition is bad or the child also has another disease, special shoes, or casts can be tried. It is not clear how well these work.
- At times, surgery is performed to correct the deformity in an adult with bad bowlegs.

KNOCK -KNEE

A deformity of the legs in which the knees are abnormally close together and the ankles are spread widely apart.

CAUSES

- **Rickets-** Rickets are the result of a vitamin D deficiency. Vitamin D helps regulate the calcium and phosphate in the blood.
- **Injury-** An injury to the knee affecting the anterior ligament causes instability to the knee in children or young adults.

SYMPTOMS

- A large difference between the angle of one leg and the other when standing straight,
- An excessive inward or outward knee angle,

pain linked to the angle of their knee, and

- Difficulty walking or an awkward way of walking.

TREATMENT

Treatment options for knock knee include:

- A change of diet, if knock knee is caused by a condition such as rickets ,
- Wearing special heel supports inside shoes to correct the line of the legs,and

surgery, although this is only considered in bad cases.

FLAT FOOT

A medical condition in which the arch of the foot collapses, with the entire sole of the foot coming into complete or near-complete contact with the ground.

CAUSES

- **Heridity** - experts say fallen arches can run in families.

- **Weak arch** - the arch of the foot may be there when no weight is placed on it, for example, when the person is sitting. But as soon as they stand up the foot flattens (falls) onto the ground.
- Bare foot walking
- Heavy Wieght

TREATMENT

- Bodyweight management.
- Custom-designed arch supports.
- Wearing an ankle brace.

GENERAL PHYSIOLOGICAL CONCEPTS

- Vital Capacity (VC) : The greatest volume of air that can be expelled from the lungs after taking the deepest possible breath.

  Vital capacity can be measured by a spirometer.

  A normal adult has a vital capacity between 3 and 5 litres. A human's vital capacity depends on age, sex, height, mass, and exercise.

  Vital capacity of an avg. Football player : 7.6

  Vital capacity of an avg. olympic athlete : 9.1

  VC=TV+IRV+ERV

  TV=**Tidal volume** is the lung **volume** representing the normal **volume** of air displaced between normal inhalation and exhalation when extra effort is not applied.

  IRV= **Inspiratory reserve volume**, or IRV, is the air a person can forcefully inhale following a normal quiet breath, which is about 2.5 to 3.5 liters

  ERV= The **inspiratory reserve volume** (IRV), about 3,100 mL, is the additional air that can be forcibly inhaled after the inspiration of a normal tidal **volume**.

Functional Residual Volume:

Functional Residual Volume (FRV) is the **volume** of air present in the lungs at the end of passive expiration.

Residual Lung Volume: **Residual** volume (RV) is a **lung volume** representing the amount of air left in the lungs after a forced exhalation.

Total Lung Volume: The **lung volumes** that can be measured using a spirometer include tidal **volume** (TV), expiratory reserve **volume** (ERV), and inspiratory reserve **volume** (IRV).

Oxygen Debt

The additional oxygen that must be taken into the body after vigorous exercise to restore all systems to their normal states is called **oxygen debt.**

SECOND WIND

- **Second wind** is a phenomenon in distance running, such as marathons or road running (as well as other sports), whereby an athlete who is too out of breath and tired to continue suddenly finds the strength to press on at top performance with less exertion.

CAUSES

- Ventelatory adjustment
- Due to lactic acids
- Improper warm up
- Fatigue in Diaphgram
- Pshycological factor

Estimated vital capacities

Males by height

Height	150–155 cm (5'–5'2")	155–160 cm (5'2"–5'4")	160–165 cm (5'4"–5'6")	165–170 cm (5'6"–5'8")	170–175 cm (5'8"–5'10")	175–180 cm (5'10"–6')
Vital capacity (cm^3)	2900	3150	3400	3720	3950	4300

Males by Age

Age	15–25	25–35	35–45	45–55	55–65	
Vital capacity (cm^3)	3425	3500	3225	3050	2850	