Exercise in Health and Disease

Dr. K. Sivapalan.

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Health

- Health ≠ Absence of Disease
- Disease:
  - abnormal state leading to inability to cope up with daily life: needs help.
- WHO definition of Health:
  - A state of complete physical, mental and social well being and not merely the absence of disease or infirmity.

Health of an Individual

- Health and disease are the two ends of one scale, where the status of an individual shifts on either side depending on various influencing factors.

Evolutionary Features of Man

- Biological existance of our species has been dominated by outdoor activity for million of years. This depended heavily on muscular activity.
- Instrumentation and automation have led to rejection of muscular activity over the last hundred years.

Aim of This Presentation

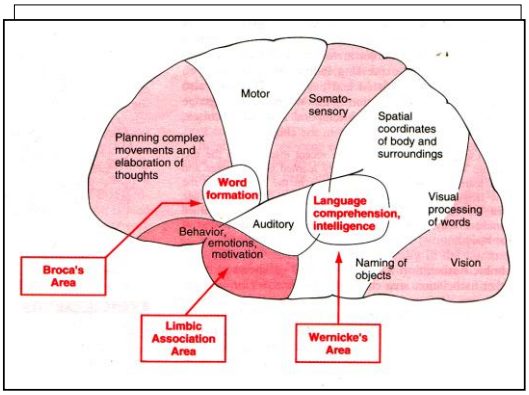
- The aim is to generate an awareness about the contribution of exercise to health, disease and life.

Exercise

- Exercise results from contraction and relaxation of muscles in sequence and the supporting skeletal system provides the leverage.
- The muscular activities are controlled by the nervous system
- Yoga is also a type of exercise.

Control of Movement

- The brain has motor cortex which controls muscles and movements
- There are association areas in the brain which analyses the perception from sensory organs and feed back from receptors sensing movements.
- Basal ganglia situated under the cerebrum plan and design movements
- The Cerebellum coordinates the movements by comparing the performance with the motor plan.



Inputs for Motor Planning

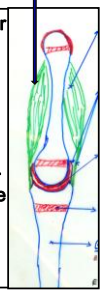
- "The Mind" decides on a course of action
- Eye, ear, vestibule (balance organ), receptors in muscles, receptors in joints and receptors in the skin – weight bearing etc. provide the initial position of the body and they continue to provide input as the movement progresses.

Motor Performance

- The brain is programmed to perform some basic movements.
- The first few attempts do not achieve in expected results.
- Repeated attempts to improve the brain commands result in improvement in movement achieving the target – training.
- Babies and children should be permitted various movements through play to perfect the motor system. Otherwise they will be handicapped.

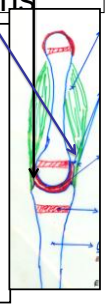
Effects of Exercise on Muscles

- Muscles need growth factors from the nerves for development.
- If they are not stimulated, muscles loose the ingredients and become week
- Repeated exercise result in development and increase in strength of muscles.
- If muscles are subjected to sudden heavy work- as in running away from danger- result in minute ruptures and soreness of muscles.
- When they heal, they will be more powerful.



Effects on Joint Capsules, Ligaments and Tendons

- Joint capsules keep joints in place: tear results in dislocation
- Tendons connect muscles with bones
- Ligaments support joints and tendons
- Stress and strain of regular exercise makes all these strong.
- Sudden excessive force may result in sprain or even rupture if they are weak

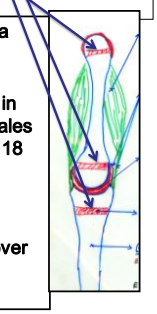


Articular Cartilage

- The surface where two bones are connected is covered by articular cartilage which gets its nutrition by diffusion from underlying bone
- A fluid between the articular cartilages aids movement by removing friction between bones.
- This cartilage becomes thick and strong by exercise.
- Excessive force on weak cartilage results in rupture of the cartilage and pain during movements for the rest of the life: osteoarthritis.

Epiphyseal Plate

- At both ends of the bones of the limbs, a special cartilaginous area is found in growing children.
- The elongation of the bone takes place in this cartilage and it disappears when males become 21 years and females become 18 years.
- There will be no growth without this epiphyseal plate.
- Normal exercise facilitates growth but over exertion may damage the cartilage and result in short stature.



Shaft of the Bone [and Teeth]

- Bones have strong collagen fibers on which calcium crystals are deposited.
- Weight bearing through regular exercise facilitates laying more fibers and calcium making bone strong.
- Lack of exercise or bed rest weakens bone- osteoporosis.
- This is a major problem for women at menopause due to hormonal imbalance.
- But woman who perform regular exercise from childhood are not affected by osteoporosis of menopause

Energy Metabolism in Exercise

- As for vehicles, activity of body needs energy which is obtained by oxidation of glucose, fat or protein- when others are available protein oxidation is minimal.
- Meals have mostly carbohydrates which are absorbed as glucose and stored in muscles and liver as glycogen until next meal and fat is stored in adipose tissue.
- Glucose and fats are released from the storage during exercise. If glycogen is exhausted, glucose is synthesized from muscle and tissue protein making them weak.
- Regular exercise with adequate meals makes tissues healthier but without good nutrition is harmful.

Nutrition and Exercise

- Energy Expenditure = energy intake ± body energy store [fat and body protein]
- Reduced food intake results in more body protein breakdown.
- Therefore, eat about 2-3 hours before exercise.
- Regular exercise improves control of blood glucose level
- Exercise and body composition-
  - Mild exercise- less fat in body [lean body]
  - No exercise- obesity
  - High exercise- muscular body

Heat Production in Exercise

- As in engines, activity generates heat in the body.
- The heat from muscles is transported to skin by blood and dissipated.
- This is facilitated by sweating which takes heat from skin by evaporation.
- Clothing in hot climate should be minimal and should facilitate heat loss; otherwise excessive sweating will occur leading to water and electrolyte shortage in body.

Role of Circulatory and Respiratory systems

- Supply of nutrients to working muscles
- Supply of oxygen to working muscles
- Removal of end products from active muscles:
  - Heat- through sweat- water and sodium are also lost
  - Carbon dioxide through lungs
  - Acids produced by metabolism

Role of Upper Airway

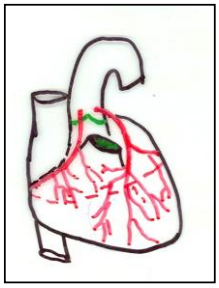
- The air has to be heated to body temperature as it enters the airway
- It has also to be saturated with water vapour and dust particles removed
- Otherwise the lungs can be damaged
- The airway has tonsils and other structures as defense against infection coming with air.
- As respiration is increased and air movement is also increased, the air way will find it difficult to deal with the above if the air is too cold or dusty.
- Some children may suffer from exercise induced asthma.

Blood Flow at Rest and Exercise

Organ	Resting- % of C O	Heavy exercise- % of C O
Lungs	100	100
Gastro-intestinal tract	20	3.5
Heart muscles	5	5
Kidneys	20	2.5
Brain	15	3.4
Muscles	15	80
Skin	5	
Cardiac Output (CO)	5 L/min	25 L/min

- The total blood flow at rest is 5 Liters / min.
- During exercise, it can increase to about 25 L / min.
- The blood pressure also changes.
- Regular exercise helps in better regulation.
- Exercise helps in treatment of hypertension

Heart and Exercise



- Resting heart rate is 72/min. It may go up to 200/min in exercise
- Regular exercise reduces resting heart rate and increases the amount of blood pumped at each beat.
- More blood vessels develop and the vessels get connected up in persons doing regular exercise.

Diseases of the Heart

- Blood vessels can be blocked by deposition of Fatty Substances in the vessel walls.
- when the block in heart vessels is partial, cardiac pain occurs on exertion; complete block results in myocardial infarction
- Regular exercise improves vessel condition and reduces the risk of the above diseases

Blood Parameters and Exercise Training

- Blood volume increased
- Fatty substances in blood reduced
- Blood cholesterol reduced
- High Density Lipoproteins [good fats] increased
- Tendency for blood clotting decreases and if clots occur, they can be dissolved before blocking vessels

Recommendation

- Regular moderate exercise as determined by,
  - Mild breathlessness [mild panting]
  - Increase in heart rate by 20-30 beats / min
  - 20-30 minutes of exercise every day
- DO NOT PERFORM EXERCISE IF,
  - Upper respiratory infections
  - Fever
  - Lung diseases
  - Acute kidney diseases
  - Problems of bones, joints or muscles
  - Liver disease
- Graded exercise with doctor's advise:
  - Stabilized heart disease, chronic kidney diseases

Seven Good Health Habits

- Regular exercise
- Regular meals
- Breakfast every day
- Maintain normal weight
- No smoking
- No alcohol. If un avoidable, moderate use
- 7-8 hours of sleep

Health is in your hands and not with your doctor. It is up to you to decide what to do with it.

Psychological Changes due to Exercise

- The person feels fit
- Less anxiety and depression
- More positive outlook in life
- More assertive, creative and self confident
- Increased problem solving abilities