RESPIRATORY BLOCK

Physiology Team~ 430

11th Lecture

Effects of exercise on the respiratory system

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Physiological process	Ventilation	Gas transfer (Diffusion) (between lung and blood)	Circulation	Diffusion (between blood and tissue)	Contraction
Organ System	Pulmonary	Resp. membrane	CVS	PO2 Gradient (Hb-O2) Disso. Curve	Skeletal muscle
Dimensions	Total Lung Capacity	Surface area	Total HB, Blood & Heart Volume		Lean body mass, & %age Body fat
Functional Capacity	MAX. Flow Rate MAX. Ventilation	Thickness, Partial pressure difference, Diffusing capacity.	C.O. Heart rate, & Stroke volume		Max. capillary circulation/ unit muscle mass, Oxidation of Hb.

Factors that affect gas exchange (all factors proportional with gas exchange except thickness of membrane is proportional inversely)

Stroke volume :
The amount of blood that the heart can pump out in one beat

Lean body mass =
weight of body – fat of body

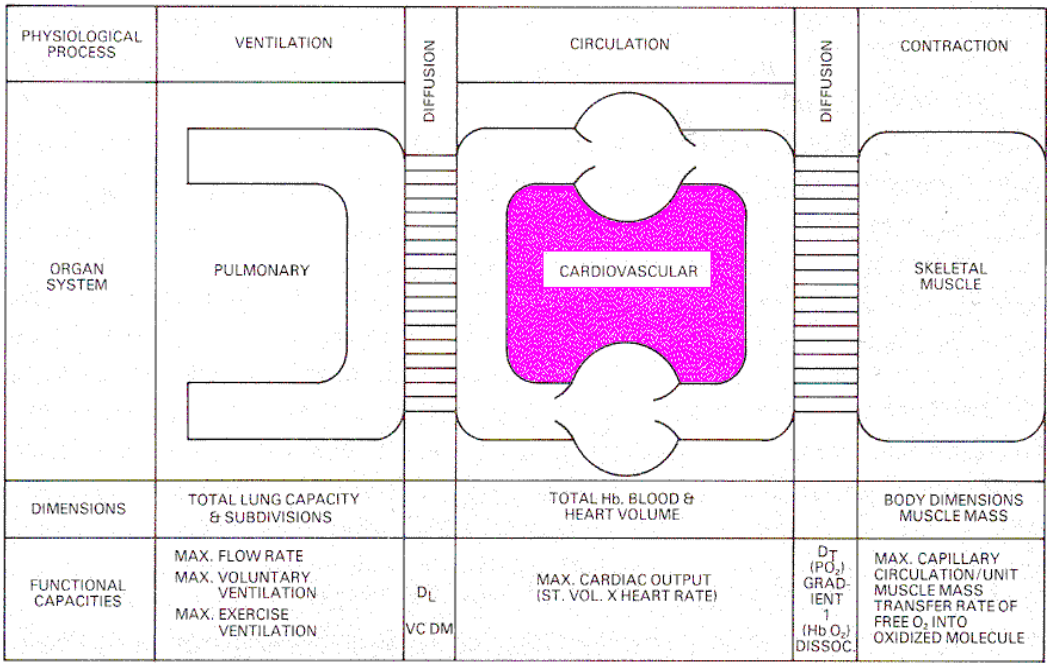
c.o.= cardiac output

Oxidation of Hb. = oxidase enzyme in mitochondria

Factors affecting diffusion from blood to tissue (increase CADET leading to shift to right so decrease affinity to oxygen and increase P50

CADET is :
C = CO2
A = Acid or Altitude
D = 2,3DPG
E = exercise
T = increase Temperature

- **Physiology of Exercise :**



- **Oxygen Transport Chain : Includes**

1- Lungs **2- Blood**

3- Heart **4- Systemic capillary circulation**

5- Muscle circulation **6- Oxidative enzymes present in muscle mitochondria**

- **Hyperventilation in exercise is explained by several factors :**

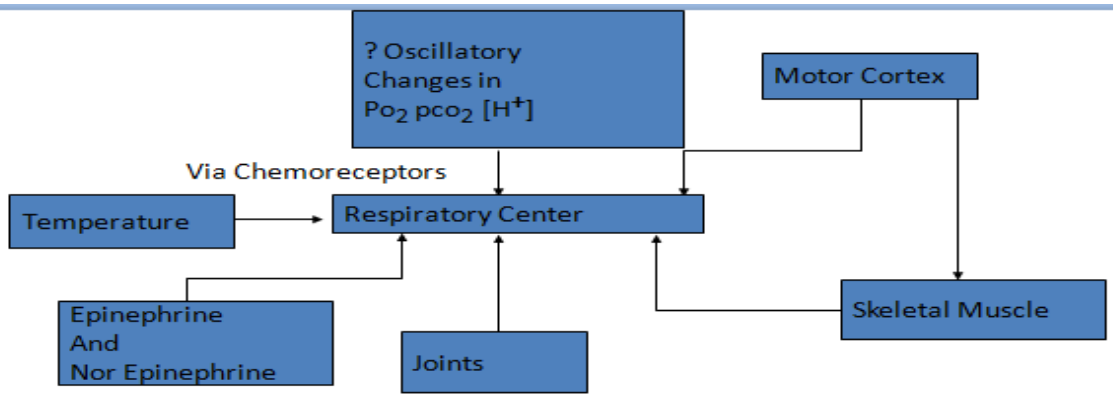
1- Anticipation of exercise → ↑ Resp.rate [cortical factor].

2- Proprioreceptors (joint receptors) → ↑ Resp.rate.

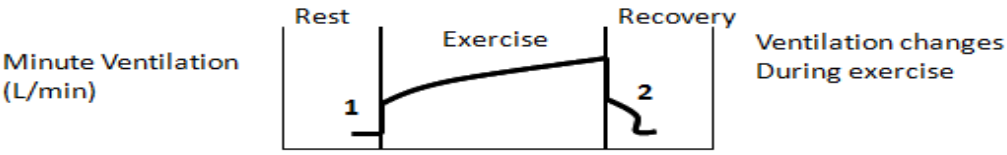
3- ↑ body temp. → ↑ Resp. rate.

4- Epineph. & Nor.epineph. → ↑ Resp. rate.

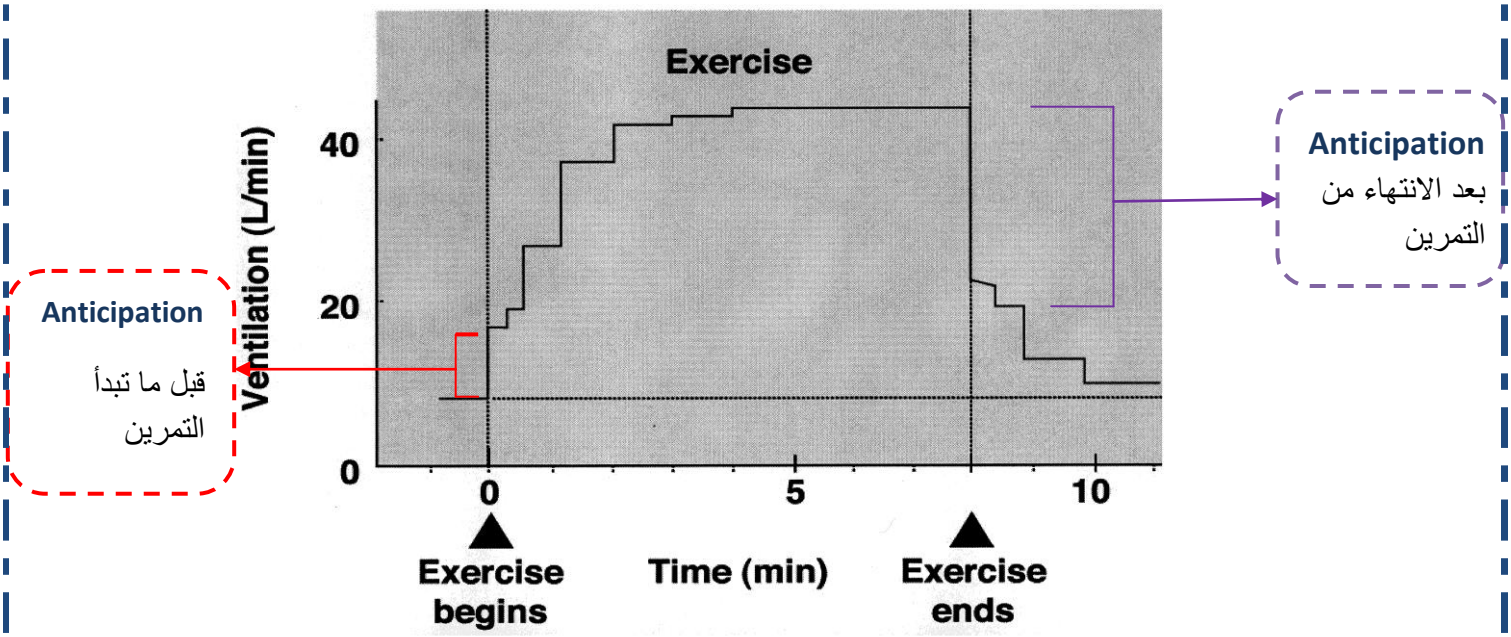
5- Lactic acid & ↓PO_2 → ↑ Resp. rate



Summary of Factors That Stimulate Ventilation During Exercise.



Note:- (1) the abrupt increase at the onset of exercise and (2) the equally abrupt but larger decrease at the end of exercise.



- **Hyperventilation continues after exercise is over because :**
  (LOOK at PIC from EXERCISE END TO TIME 10)

  1- Lactic acid will take some time to be converted to glucose.

  2- Temperature will take some time to return to normal.

  3- Oxygen debt (Excess O_2 after end of exercise)

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- **In normal healthy man exercising at sea-level the limits of exercise are set by:-**

  The cardiovascular system at maximal levels of Cardiac output (heart rate x stroke volume)

  …….

-- Stroke volume reach its peak at 40% of maximum exercise intensity, but heart rate continues to rise.

-- Exercise ventilation is usually 70-80% of maximal Potential.

So you can't reach to 100% of maximal potential

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- **Oxygen Debt :** Excess post exercise O_2 consumption

  Required to convert :

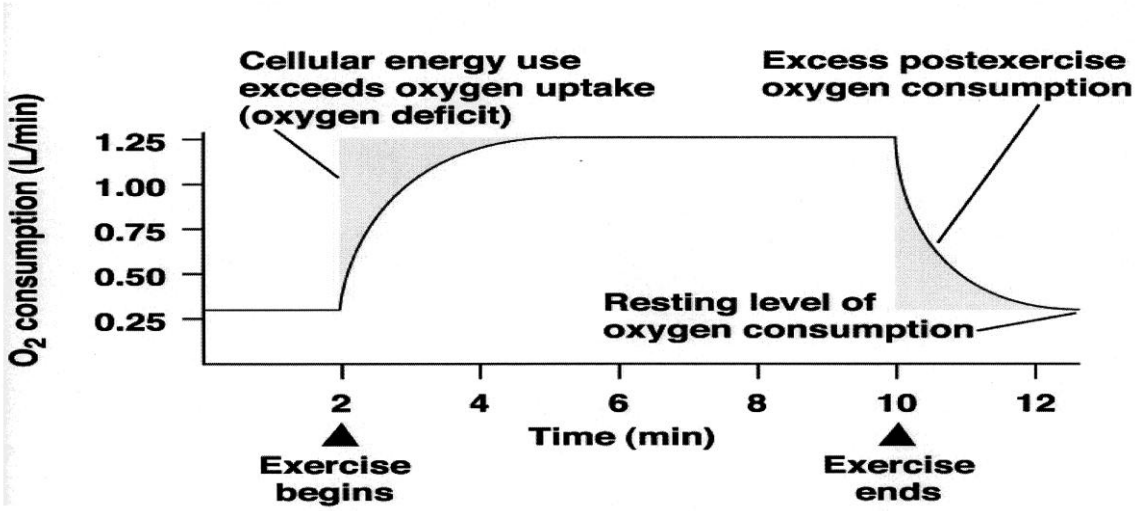
  1- Lactic acid to glucose.

  2- ADP → ATP.

  3- Creatine phosphate to its original state.

  4- body temperature to normal.

- **Oxygen Deficit :** Cellular energy use exceeds O_2 uptake.



- **Isometric Contraction:**
  - Produces no movement
  - Used in Standing , Sitting and Posture.

-- ↑ Intramuscular pressure limits blood flow → hard work with too little O2 → anaerobic metabolism → ↑ lactic acid, and a rise in ADP/ATP ratio and fatigue.

-- B.P. (blood pressure) rise more and C.O.(cardiac output) and H.R.(heart rate) less than in dynamic exercise.

Isometric contractions produce no movement. They are used in standing, sitting and maintaining our posture. For example, when you are standing muscles in your back and abdomen pull against each other to keep you upright. They do not produce movement, but enable you to stand.

- **Isotonic Contraction: (dynamic exercise)**
  - Produces movement
  - Used in Walking and Moving any part of the body

Isotonic contractions are the types that produce movement. Isotonic contractions are used in walking and moving any part of the body.

- **People regularly active in dynamic exercise have larger :**
  1- Left ventricular volume.
  2- Resting and exercise stroke volume.

- Exercise has a role in preventing and recovery from several cardiovascular diseases.
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- Regular exercise often, but not always ,reduces resting blood pressure.
- Chronic physical activity enhances insulin sensitivity and glucose entry into cells.

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