RESPIRATORY BLOCK

Physiology Team~ 430

12th Lecture
Parameters for measuring work capacity

Done By :

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• Respiratory Changes in Exercise

- In Exercise :
  both Rate and Depth of Respiration, and O_2 consumption increase.

- For each one liter of oxygen consumed , 5 kilocalories of energy are liberated

- Normal Resting O_2 Consumption = 250 mls⁄min.
  but during exercise it can reach up to 20 times as much (2.5 L/min).

- The greater oxygen you consume = the greater energy output

- Normal Resting Respiratory Minute Volume (RMV) = 6–8 Lit.⁄min.
  - can reach up to 100 L/min depending on the kind and intensity of the exercise

RMV = Tidal volume(TV) x respiratory rate (RR)

  - RMV increase because :
    Tidal volume and respiratory rate increase

For your information

Why does the tidal volume increase during exercise ?

When exercising you Tidal Volume increase because your breathing at a faster rate and your muscles are using up the oxygen at a quicker rate hence a need for more oxygen hence you body increasing the Tidal Volume to allow more oxygen to be consumed and meet the muscles oxygen demands.

- **The Diffusing Capacity Of The Respiratory Membrane:**

Is the volume of gas which diffuses through the respiratory membrane per minute per mmHg. difference in pressure.

At Rest = 21 mls./min./mmHg.

In Exercise it can reach 65 mls. /min./mmHg.

due to:

1- Dilatation of the pulmonary capillaries.

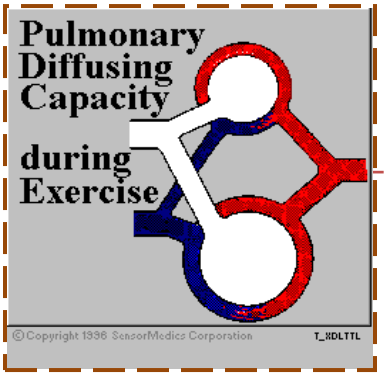
2- Opening of the dormant pulmonary capillaries.

3- Increased alveolar ventilation.

Dilatation = more blood will Diffuse = more gas will Diffuse

Dormant : close ,

but in exercise will open = more blood will Diffuse = more gas will Diffuse



Diffusion capacity

In exersices is increased dut ot :

- Large area and low blood and air (dilatation)

- Dormant capillaries are going to be functional

حتى يستفيد من كمية أكبر من الأكسجين في الـrespiratory membrane

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

It is energy expenditure at complete physical and mental rest, 12 hours after the last meal, in a comfortable temperature.

= 43 Kcal. / m2 / hour, (2000 Kcal / day.)

BMR: is the minimum energy needed for vital functions.
the body's vital functions

Vital functions :
RS - CVS - Endocrine - Glucose level - PH - Temp.
(note the enzyms have optimal dgree of heat .
If increase heat degree lead to catalyze reaction in fast way.
But if heat degree is too high it will make enzyme inactive form.)

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- **Energy systems:**

Cells generate energy by three methods:-

1- ATP system: produced in mitochondria

2- Creatin phosphate system: (CP)
CP + ADP → ATP + creatin.
CP is broken down in muscles to form ATP

3- Anaerobic system: (glycolytic)

a. Glucose in blood

b. Glycogen

➔ More lactic acid (acidosis) ➔ less amount of ATP complete glycolysis

4- Aerobic system: (oxidative)

use of O2 (excess amount of ATP, more than anaerobic).

system	Duration of exercise
ATP	First few seconds
Creatin phosphate	First few seconds
Anaerobic	few minutes
Aerobic	hours

- **Creatine :** Molecule capable of storing ATP energy
- **Creatine Phosphate:** Molecule with stored ATP energy

Creatine Phosphate + ADP ➔ ATP + creatin

- **Energy is required for:-**
  - Synthesis of new materials.
  - Transport against concentration gradient.
  - Mechanical work.
  - Production of heat.

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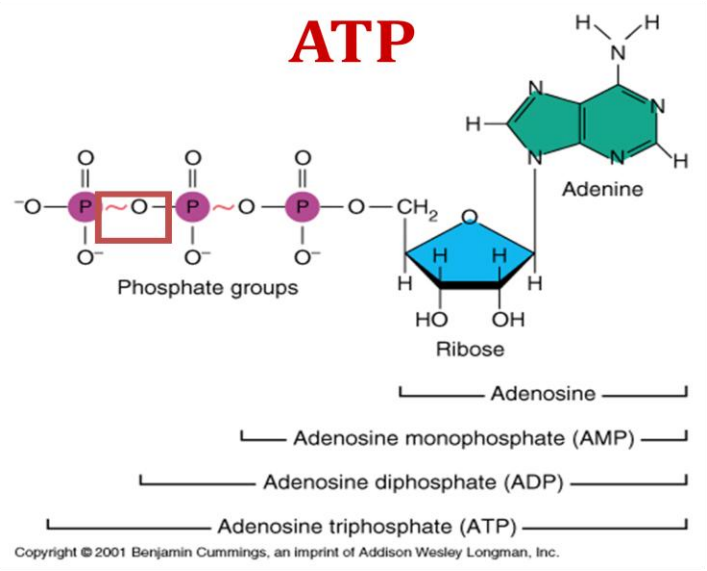

-- ATP or adenosine triphosphate is the form of energy that muscles and all cells of the body use.

-- The chemical bond between the last two phosphates has just the right amount of energy to unhook myosin heads and energize them for another contraction.

-- Pulling of the end phosphate from ATP will release the energy.

-- ADP and a single phosphate will be left over.

-- New ATP can be regenerated by reconnecting the phosphate with the ADP with energy from our food.

- **Muscle Atrophy:**

  Decrease in the mass of the muscle (Weakening and shrinking)

  -- May be caused by :

  Immobilization

  Loss of neural stimulation

- **Muscle Hypertrophy:**

  Increase of the size of muscle cells.

  More capillaries ➔ more O2

  More mitochondria ➔ more ATP

  -- Caused by :

  Strenuous exercise

  Steroid hormones

- **Steroid hormones:**

one of the body's major growth hormones ➔ promotes anabolism ➔ consequently promotes hypertrophy

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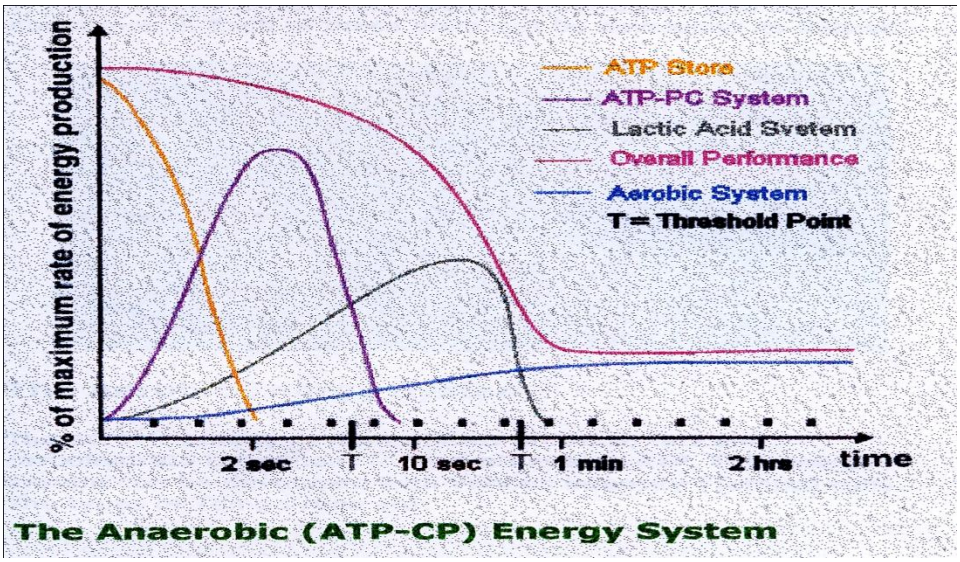
■ **Energy production is both time and intensity related.**

Exercise for longer periods of time require the complete oxidation of CHO and free fatty acids (aerobic system).

■ **CHO stores last for approx. 90 min. and FFAs will last for several days.**

فلذلك أي شخص يريد تخفيف وزنه يجب عليه أن يستمر لمدة ٣٠ دقيقة في أيام محددة في الأسبوع بشكل منتظم لكي يستنفذ الكربوهيدرات أولا ثم يبدأ بحرق الدهون

ولو لم ينتظم فسيخزن الجسم الكربوهيدرات التي سيستعملها في الرياضات القادمة بدلا من الدهون



Note:

- First seconds of exercise, ATP stored is the main source of energy.
- During one minute of exercise, you use anaerobic energy.(lactic acid system)
- Using aerobic energy takes hours.(fatty acid system)

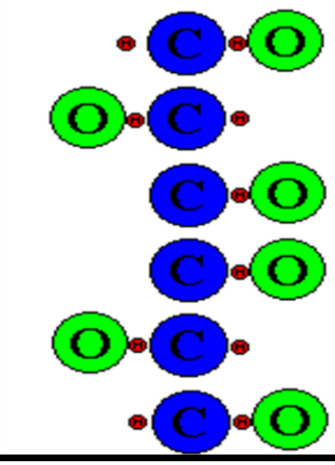
- **Respiratory Quotient :**

-- It is the ratio of carbon dioxide produced /ratio of Oxygen consumed, (CO2/O2.)

-- If carbohydrate is the only source of energy, the ratio will be = 1.00

-- If fat is the only source of energy the ratio will be = 0.7

-- If it is a mixed diet the ratio will be = 0.83 (Mix diet → كل أنواع الغذاء مع الدهون)

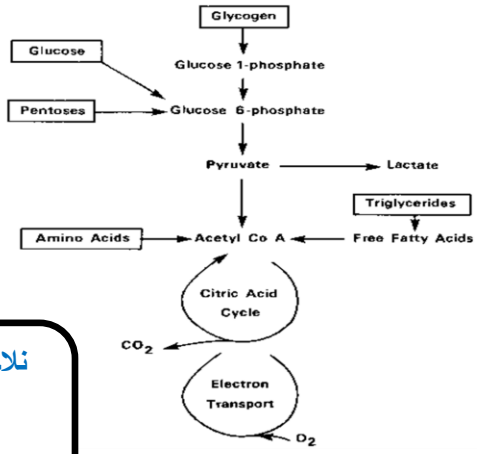


Aerobic metabolism

6 Glucose + 6 O2 = 6 CO2 + H2O

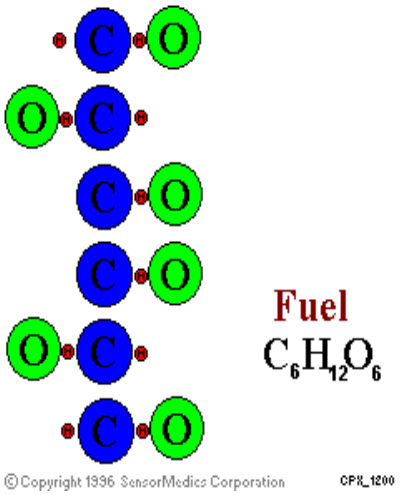
Fuel

$C_6H_{12}O_6$



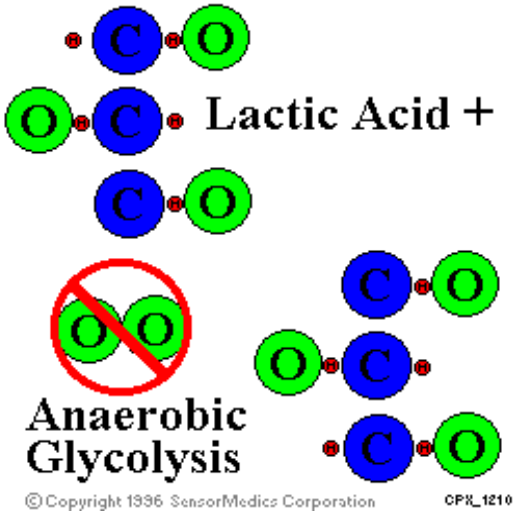
نلاحظ هنا انه استخدمنا كربوهيدرات وعدد الاكسجين المستخدم يساوي عدد ثاني اكسيد الكربون فبالتالي

Respiratory Quotient=1

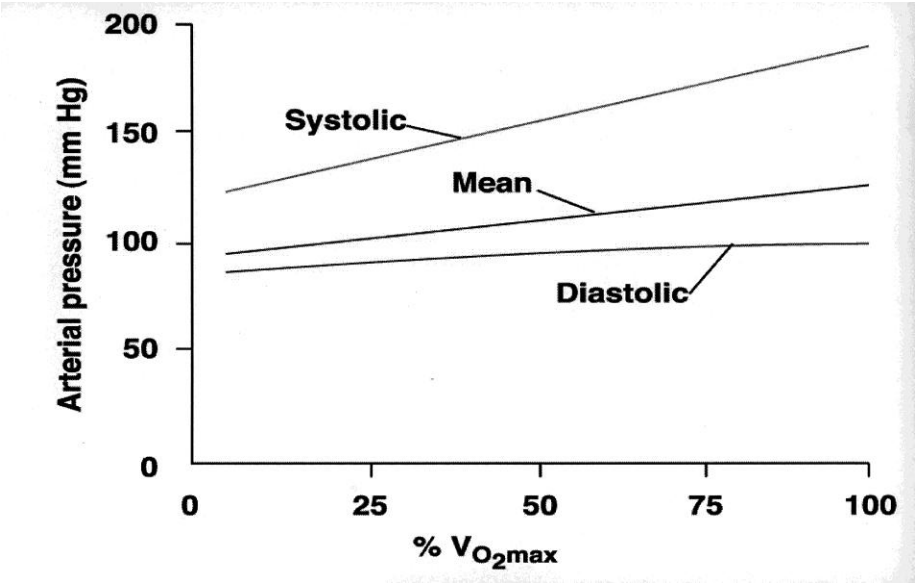


Fuel

$C_6H_{12}O_6$



بعد تكيسر الجلكوز في العملية الاهوائي ينتج ٢ لا كتك اسد



Systolic: The blood pressure when the heart is contracting. It is specifically the maximum arterial pressure during contraction of the left ventricle of the heart. The time at which ventricular contraction occurs is called **systole**.

Diastolic: Referring to the time when the heart is in a period of relaxation and dilatation (expansion). The diastolic pressure is specifically the minimum arterial pressure during relaxation and dilatation of the ventricles of the heart when the ventricles fill with blood.

- **Fatigue :**

The exercise fatigue has been suggested to be effected by:

1- inactivation of the ion pumps → in excitability & muscle weakness.
2- brain hyperthermia.
3- glycogen depletion in brain cells.
4- reactive oxygen species impairing skeletal muscle function.
5- Fatigue in diaphragm and abdominal respiratory muscles limiting breathing.
6- Impaired oxygen supply to muscles.
7- Ammonia effects upon the brain.

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- **Lean Body Mass (LBM) :**

LBM = Body weight –Total body fat in Kgs.

-- Body fat can be measured by:-

1- Skin fold calipers.

2- Under water weighing.

Good Luck