RESPIRATORY EXCHANGE RATIO

$$RER = VCO_2/VO_2$$

<u>Oxidation of a molecule of ***Carbohydrate***</u>

$$6\ O_2 + C_6H_{12}O_6 \longrightarrow 6\ CO_2 + 6\ H_2O + 38\ ATP$$

$$RER = VCO_2/VO_2 = 6\ CO_2/6\ O_2 = 1.0$$

<u>Oxidation of a molecule of ***Fatty Acid***</u>

$$23\ O_2 + C_{16}H_{32}O_2 \longrightarrow 16\ CO_2 + 16\ H_2O + 129\ ATP$$

$$RER = VCO_2/VO_2 = 16\ CO_2/23\ O_2 = 0.7$$

Now that I know how to calculate R, what does this mean to me?

1. You can determine what fuel is being used for energy production

2. You can calculate energy expenditure for a given activity

R	Energy Expenditure kcal/L O_2
0.71	4.69
0.75	4.74
0.80	4.80
0.85	4.86
0.90	4.92
0.95	4.99
1.00	5.05

For example, if I am exercising and consuming 2.0 L of O_2/min and my R value is 0.85 I will be expending 9.72 kcal/min (2.0 L of O_2 x 4.86 kcal/ O_2 = 9.72 kcal/min). Thus, if I exercise for 30 min I will burn 292 kcal.

If however, I exercise at a lower intensity and my oxygen consumption is 1.0 L/min with an R of 0.71, I will burn only 4.69 kcal/min (1.0 L of O_2 x 4.69 kcal/ O_2 = 4.69 kcal/min). Thus, if I exercise for 30 min I will burn 140 kcal.

See **TABLE 4.5** on Page 144 – Energy Expenditure

Excess Post-Exercise Oxygen Consumption (EPOC)

Due to:

1. Replenishing of the ATP/CrP stores
2. Increased levels of catecholamines in the blood
3. elevated rates of fatty acid oxidation
4. increased body temperature
5. continued substrate cycling

Maximal Oxygen Uptake (VO_{2max})

1. Regarded as the best measurement of aerobic capacity

2. Refers to the maximum volume of oxygen that can be consumed per minute and used for aerobic energy production

3. Linear relationship between VO_{2max} and exercise intensity

Lactate Threshold

1. Single best predictor of aerobic (i.e., endurance) exercise performance.

2. Usually expressed as % VO_{2max}

3. Aerobically trained individuals typically have a lactate threshold that is greater than that of untrained. This is a result of the aerobically trained athletes having a more developed ability to generate energy aerobically and results in less lactate being produced.

    UT: 50-60% VO_{2max}
    TR: 70-80% VO_{2max}

CAUSES OF FATIGUE

1. **Short duration, high intensity exercise**
    a. CrP depletion
    b. Metabolic By-products
        1. Increased lactate concentration [HLa], which increases [H^+].
            a. Decreased pH
            b. Decreased rate of glycolysis
            c. Interferes with Ca^{2+} binding to troponin

2. **Prolonged endurance exercise**
    a. Glycogen depletion
        1. Muscle glycogen levels
            a. Muscle glycogen declines throughout exercise
            b. As muscle glycogen levels decline, there is an increased reliance on blood glucose
        2. Liver glycogen levels
            a. Liver glycogenolysis attempts to maintain blood glucose levels
            b. When liver glycogen levels fall and the rate of liver glycogenolysis is less than the rate of muscle glucose uptake the blood glucose concentration declines
            c. Time to fatigue due to an inability to provide an adequate supply of carbohydrate to the muscle