Name: Date:

2.2.14 – 2.2.16

Discuss the variability of maximal oxygen consumption in selected groups.

- Maximal oxygen consumption represents the functional capacity of the oxygen transport system and is sometimes referred to as maximal aerobic power or aerobic capacity.
- The VO_2 is directly assessed by measuring the gas concentration and the volume of air being breathed out at progressively increasing intensities of exercise.

2.2.15 iscuss the variability of maximal oxygen consumption in selected groups

When comparing $\dot{V}O_2max$ values between different populations it is crucial to recognise that the values can be expressed in two formats:

- **absolute** $\dot{V}O_2max$ is reported in $L.min^{-1}$
- **relative** $\dot{V}O_2max$ is the same value but normalised according to body mass in $ml.kg^{-1}.min^{-1}$.

For activities that are considered weight-bearing it is more appropriate to use the relative $\dot{V}O_2max$ values as this makes an attempt to account for individual differences in size and mass. This is important as differences in size and mass explain the majority of the variability in absolute $\dot{V}O_2max$ values between individuals, due to factors such as active muscle mass, heart size, blood volume etc.

For example, an untrained healthy adult with a body mass of 70 kg may have an absolute $\dot{V}O_2max$ of 3.0 $L.min^{-1}$, which means a relative $\dot{V}O_2max$ of 42.9 $ml.kg^{-1}.min^{-1}$ (3.0×1000 to convert L to ml, then divide by 70kg). In contrast a 58 kg female hockey player may also have an absolute $\dot{V}O_2max$ of 3.0 $L.min^{-1}$, yet her relative $\dot{V}O_2max$ of 51.7 $ml.kg^{-1}.min^{-1}$ reflects her training adaptations that mean she will be able to run at faster speeds and for longer than the untrained male. Highest values of $\dot{V}O_2max$ have been recorded

Young Vs Old

- Older people have a much lower VO2 MAX.
- From adulthood, in males and females, relative VO2 declines approx. 1% each year.
    - - This is due to gradual decline of their max HR
    - A healthy 20yo male has a VO2 max of 45 ml.kg
        - Same person at 45 and 70yo would be 35 and 27.2 ml.kg

Trained Vs Untrained

- A VO2 MAX exceeding 60ml is an indication of a trained athlete.

- Highest values of VO2 max recorded was in cross-country skiers – 90ml.kg in males, 75ml.kg in females

- Trained athletes are able to demonstrate their full cardio-respiratory potential, while untrained athletes yield fatigued muscles and are only able to reach sub-maximal levels.

Males Vs Females

- Absolute VO2 max values are lower for age-matched females.

- Heart size scales in proportion to lean body size, so therefore the male heart is usually bigger than the female heart. Stronger pump results in an increase in MAX VO2.

- Males also have a slightly higher hemoglobin concentration

What limits $\dot{V}O_2$max?

Although we can see from Figure 2.1 that a limitation could occur anywhere in the oxygen transport system when $\dot{V}O_2$max is reached, it is widely believed that in the majority of healthy individuals the primary limitation is the capacity of the cardiovascular system to deliver oxygen. There are exceptions to this rule, including illness and extremely high aerobic fitness levels, but in most cases it is believed that the ventilation system and oxygen use at the muscle do not cause someone to reach $\dot{V}O_2$max.

How does training increase VO2 max?

- Training induced changes to the heart and cardiovascular system (central adaptations) and changes within the muscle (peripheral adaptations)
- Main training response is increase in stroke volume and the time and effort it takes someone to reach their max heart rate (can work harder before reaching it)
- Stroke volume increases due to increases volume of left ventricle.

2.2.16 Discuss the variability of maximal oxygen consumption with different modes of exercise

- Consider cycling versus rowing.
- Explain: