Excess Post-exercise Oxygen Consumption

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Key terms

- EPOC – Excess Post Oxygen Consumption
- TDEE – Total Daily Energy Expenditure
- BMR – Basal Metabolic Rate
- RMR – Resting Metabolic Rate
- NEAT – Non-Exercise Activity Thermogenesis
- ROC – Recovery Oxygen Consumption
- Thermogenesis – Heat production in organisms

Background

- A decrease in RMR & TDEE = An increase in weight gain
- Eating food and digesting food creates heat (thermogenesis)
- Thermogenesis kicks in to drive metabolism from oxygen consumption (Clapham 2012)
- An increase in NEAT means that thermogenic processes are more active at rest
- So, for weight control/loss we want an increase in NEAT as this will lead to a decrease in bodyfat gain

EPOC definition

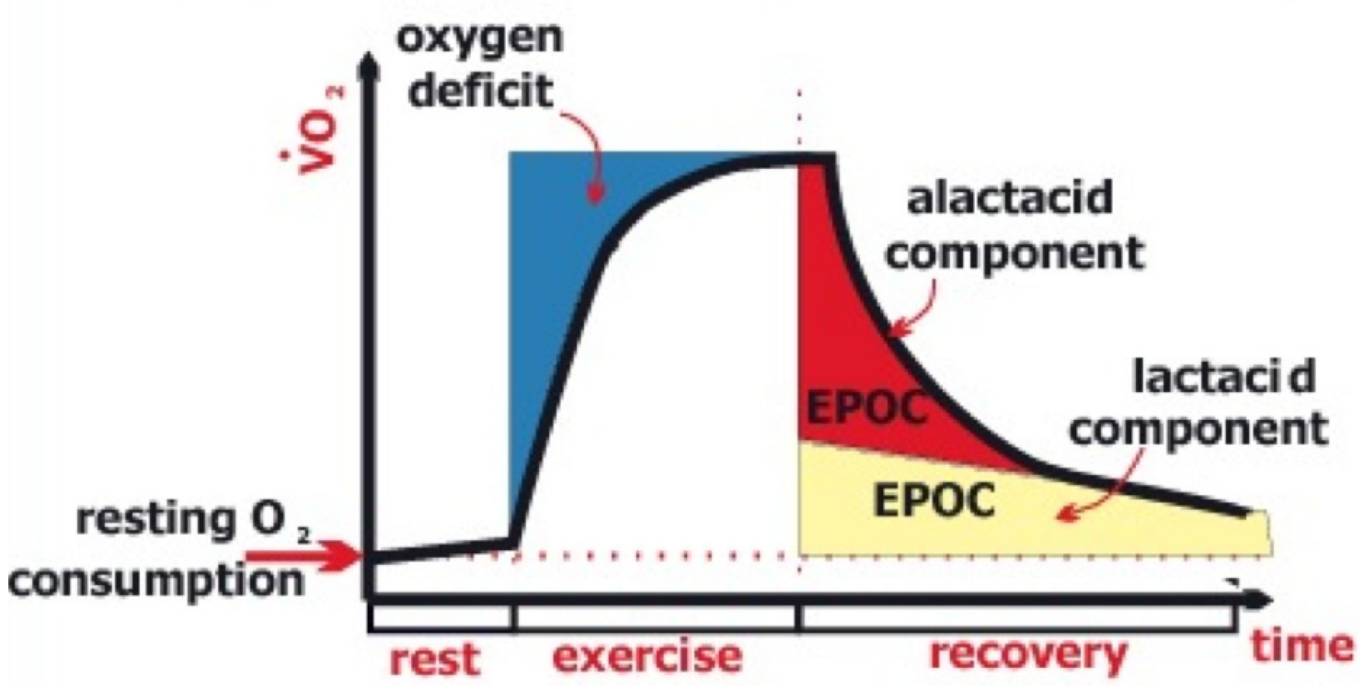
“EPOC is referred to as an increased metabolism during recovery from a session of exercise”

(Laforgia et al. 2006)

What is EPOC?

- EPOC is a cardiorespiratory response to attempt the replenishing of the body's phosphagen system (energy system), initially to start returning to homeostasis (resting values)
- It consists of a fast (1hr) and extended (continuation) component (Bahr & Sejested 1991)
  - Fast component = ATP/PC recovery, lactate removal, ion redistribution, HR, body temp, acute tissue repair
  - Extended = Krebs cycle activation with Free Fatty Acid (FFA), hormone activity, myoglobin re-synthesis, glycogen replenishment
- Both fast and slow components involve an increase in oxygen consumption from resting values once exercise has ceased

Oxygen consumption during/post exercise



EPOC notes

- EPOC increases linearly with exercise duration (Bahr et al. 1987)
- Exercise intensity determines both EPOC magnitude and duration (Gore & Withers 1990)
- Exercise duration impacts EPOC duration post exercise (Gore & Withers 1990)
- Higher intensity is key (Laforgia et al. 1997)

EPOC & HIIT

- HIIT increases Sympathetic Nervous System (SNS) Activation (Borsheim et al, 1994), speeding up metabolism
- HIIT increases catecholamine activation (adrenal gland hormones) (Quinn et al, 1994), increasing metabolism
- HIIT increases the metabolic cost & rate of calorie burn (Thorton & Potteiger, 2002)
- HIIT causes the synthesis of myoglobin (O_2 binding protein in muscles) & haemaglobin (Sedlock et al, 2004), increasing metabolism
- HIIT increases lipolytic responsiveness in the adipocyte (increased fat utilisation) (Trost et al, 1997), making fat burn easier
- HIIT causes increased fat oxidation (Hunter et al. 1998)

How does EPOC work?

- The more intense the exercise the greater the metabolic cost = greater biological stress & recovery (Foureaux et al, 2006)
- The EPOC mechanisms concurrently increase RMR by acutely increasing metabolic rate by chronic repetition of training stress induced bouts (Foureaux et al, 2006).
- The response to HIIT exercise forces your body to actively use oxygen more in restoration processes, therefore this = a more O_2 efficient body (fat usage).

Foureaux et al. (2006)

EPOC benefits

- EPOC is related to increased metabolism both during and acutely after exercise (Foureaux et al, 2006)
- Studies show increases in metabolism equating to 7-15% over a 24 hour period. Therefore if RMR is 2000kcals for 24 hrs, an increased EPOC kcal burn could be as much as 300kcals
- Considering that VO_2max and intensity are related, increased intensities of exercise = increased EPOC response (Laforgia et al, 2006)

However…

- Subtle differences between FITT principles can determine the degree of EPOC's physiological action
- Some studies have shown that energy expenditure and the duration of EPOC has is similar between exercise intensities (Sedlock et al, 1989)
- Disparities in EPOC responses are due to muscle mass involved, exercise intensity and duration, training status and food ingestion (Imamura et al, 2004)
- Research is unclear as to an exact biological trigger of the EPOC response (Foureaux et al, 2006)

EPOC & Weight Loss

- More intense exercise = increased metabolic rate = increased EPOC
- Fat loss is more preferable with intermittent interval type exercise (Laforgia et al, 1997)
- EPOC magnitude more important than duration for weight loss (Imamura et al, 2004). In other words, reaching high exercise intensities is key
- Helps to enhance the action of RMR (Larsen et al, 2014)

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