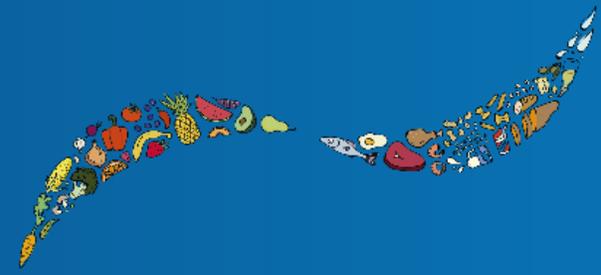


NUTRITION & EXERCISE-INDUCED MUSCLE DAMAGE

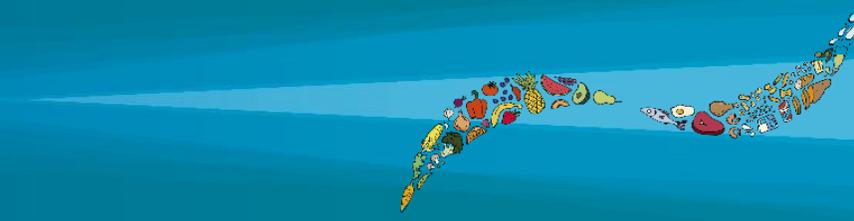


Exercise-induced muscle damage results in muscle soreness and a temporary loss in muscle function.

Nutrition interventions can be employed to accelerate recovery and ameliorate soreness but a strategic approach should be followed.

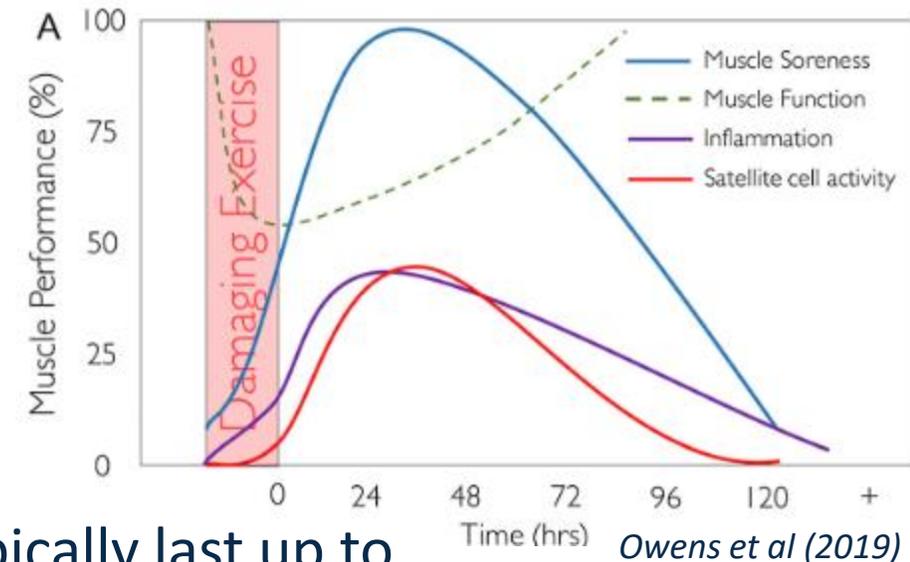


WHAT IS EIMD?



Exercise-induced muscle damage (EIMD) is a transient phenomenon characterised by the symptoms presented following high-intensity or novel exercise. These symptoms typically include **decreased muscle force production, decreased exercise capacity, decreased range of motion and increased muscle soreness.**

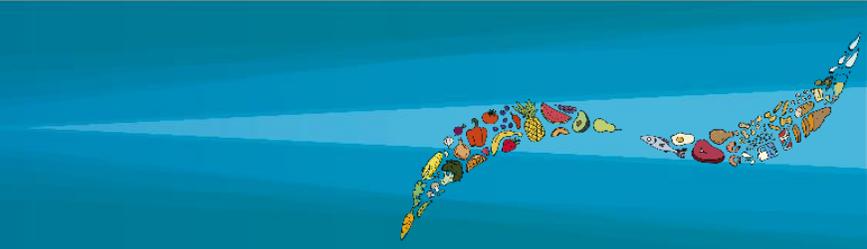
The symptoms may begin immediately following exercise, typically last up to **7 days** and the magnitude depends on the exercise **intensity** and **duration.**



EIMD occurs because of **micro-damage to muscle fibres** and many of the symptoms are related to this damage and the **subsequent inflammatory** response required to repair the damaged tissue. EIMD should **not** be viewed **negatively** and muscle damage and the subsequent repair response is a **key part of the adaptation and remodelling** process.

SORENESS
≠
INJURY

WHAT CAUSES EIMD?



A level of muscle damage occurs with all forms of exercise but the **extent** of the damage will be related to the **type** and **intensity** of exercise and the individuals susceptibility to muscle damage.

Typically, **resistance training**, **running** and **high-intensity intermittent** exercise are the common causes of EIMD in swimmers.

More specifically, **eccentric** muscle actions under **load** and/or at **fast** velocities are likely to cause a greater extent of damage (*e.g. the lowering portion of a weighted pull-up or repeated jumping movements*).



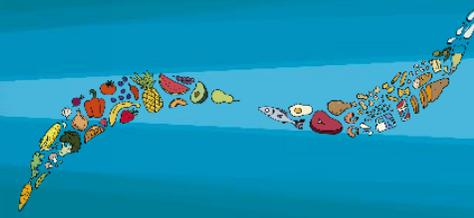
EXERCISE TYPE

A muscle's susceptibility to damage might also be reduced for subsequent bouts where prior exposure to the exercise has occurred. This may explain the increase in soreness observed when an experienced athlete engages in a novel form of exercise.

EIMD & DOMS

DOMS stands for **D**elayed **O**nset of **M**uscle **S**oreness and represents the increased muscle soreness which often occurs 8-24h after damaging exercise. Typically it peaks 24-48h after exercise and subsides within 96h. DOMS is used as a marker for EIMD.

EIMD & NUTRITION



Whilst there are many effective strategies to help manage the soreness and decreased range of motion caused by muscle damage (*e.g. active recovery, sleep, stretching, massage etc.*) our diet can also play a key role in repair and recovery.

The role of nutrition in EIMD can be split into two areas: **Chronic & Acute**

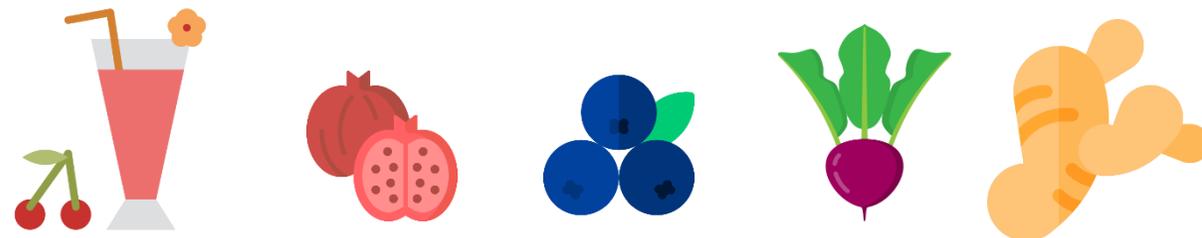
CHRONIC

Foods which should be part of the **everyday diet** and exist before, during and after EIMD

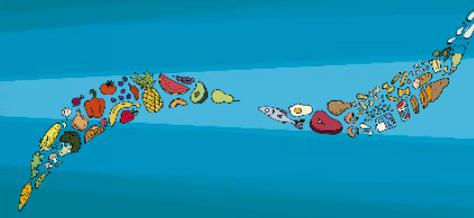


ACUTE

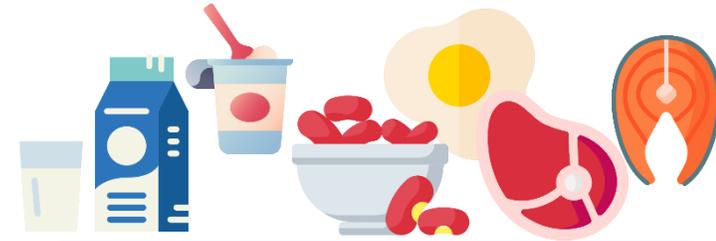
Strategies which can be **specifically** employed in **response** to EIMD to promote repair and recovery – Often consumed in excess of normal dietary intakes or in concentrated amounts



CHRONIC DIET STRATEGIES



Protein intake is an important regulator of protein turnover and muscle protein repair is a critical component of recovery from EIMD. It's currently **unclear** whether an **increased protein intake** after EIMD accelerates recovery but most certainly a **sub-optimal** protein intake will **compromise** muscle **repair**.



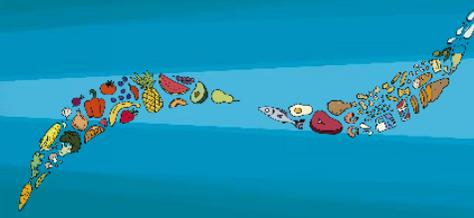
**Optimal Protein Intake:
1.4-2.0g/kg**



**Aim for >7
servings per day**

Fruits and vegetables are rich in compounds known as **polyphenols**. These polyphenols possess **antioxidant** and **anti-inflammatory** properties which are beneficial in tissue repair and pain management. Whilst some isolated polyphenols (*see acute strategies*) may be beneficial in greater amounts, pragmatically, a **diet rich and varied** in fruit and vegetables may be the best strategy to augment recovery from damaging exercise.

CHRONIC DIET STRATEGIES



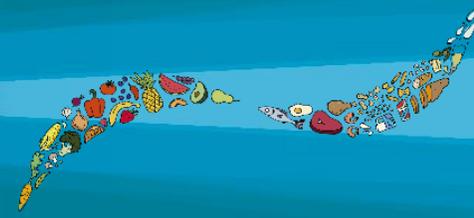
Omega-3 fatty acids possess strong **anti-inflammatory** properties which work in a similar way to non-steroidal anti-inflammatory medications. So regular and sufficient consumption can help **control the inflammatory response** following EIMD and **speed up recovery**. Key dietary sources are **oily fish** (*salmon, mackerel, trout*), **nuts** and **seeds** (*walnuts, flaxseed, pumpkin seeds*) and omega-3 enriched **eggs** but omega-3 supplementation may be advisable if dietary intake is low.

Vitamin D has wide ranging effects but some of its key roles are the regulation of our **immune** system and the **repair** of **muscle** tissue. Research shows improved muscle recovery and inflammatory response following EIMD in **Vitamin-D sufficient** individuals.

As the majority of our Vitamin D is made from **sun exposure** it is important to maintain sufficient Vitamin D levels in the **winter** months and often supplementation is recommended (*for more information see the Vitamin D resource*).



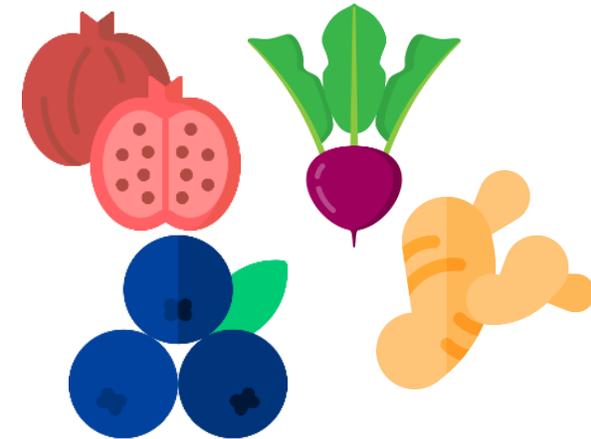
ACUTE DIET STRATEGIES



Concentrated tart cherry juice has been shown to reduce **soresness** and **accelerate** muscle **recovery** when taken before and after damaging exercise. 30-60ml of juice is often recommended, the equivalent of **100-200 cherries!**

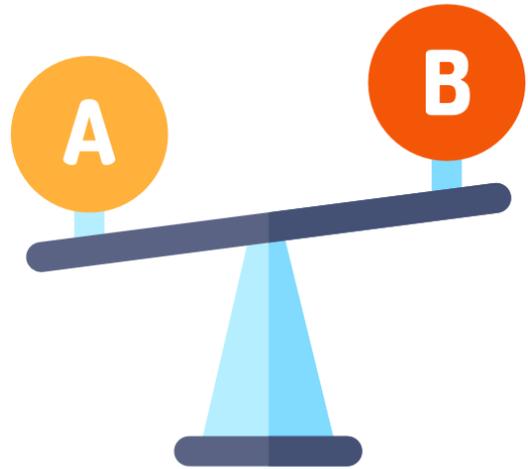
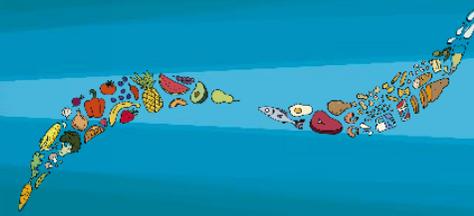


There is also emerging support for **blackcurrant** extract, **pomegranate** juice, **beetroot** juice, **curcumin** and **ginger** as promising interventions to manage EIMD but the exact dosages and usage remains **unclear**. In the absence of clear guidance this further supports the consumption of a **balanced** and **varied** diet rich in **plant-based foods** (*see the 'Fruit and Veg for Fast Swimming' resource for further information*).



It's important to note that much of the research investigating the role of acute nutrition interventions involve the consumption of these foods for many days prior to the bout of damaging exercise. Therefore, it is unclear what impact these may have if only consumed reactively to EIMD.

RECOVERY v. ADAPTATION...

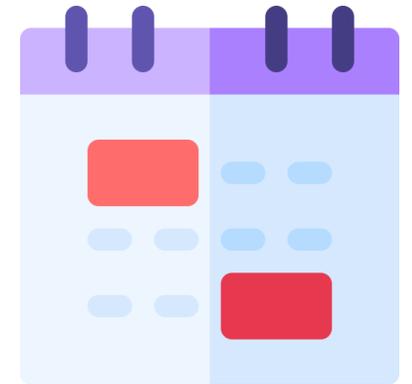


It's important to note that many of the nutritional interventions highlighted here may modulate **oxidative stress** and **inflammation** which are known to be **important** in the **adaptive** response to an exercise stimulus.

This leads to the consideration of what is of greater importance; **recovery** or **adaptation** from the exercise stimulus.

Undoubtedly, there will be times when recovery must be **prioritised** (*e.g. competition*) whereas an increased stress response and subsequent training adaptation may be of greater during general preparation phases.

Therefore, swimmers and coaches are encouraged to consider a **periodised** approach to nutrition and recovery to maximise the potential for **training adaptation** against the swimmers **acute recovery** needs in line with the **phase aims**.



Further Reading

Owens *et al* (2019) Exercise-induced muscle damage: What is it, what causes it and what are the nutritional solutions?
Harty *et al* (2019) Nutritional and Supplementation Strategies to Prevent and Attenuate Exercise-Induced Muscle Damage: a Brief Review