

LET'S TALK ABOUT LOW ENERGY AVAILABILITY

RELATIVE ENERGY DEFICIENCY IN SPORTS
(REDS) & DANCE (RED-D)



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LUCY LAWTON

DO THEY EAT ENOUGH FOR WHAT THEY DO?

Traditionally we have associated injuries with doing too much, but that does not explain why some kids get injured and others doing the same amount, or intensity of sport remain injury free.

Many non contact injuries occur when we exceed the current capacity of the body. That may be doing more than they have trained for, but can also be due to a drop in capacity due to inadequate sleep, nutrition or recovery and they may not be able to tolerate their usual activity level.

Adolescents who participate in sports often need more energy intake to optimise wellness, growth and performance than their non-athletic peers, but they are not always aware of that fact.

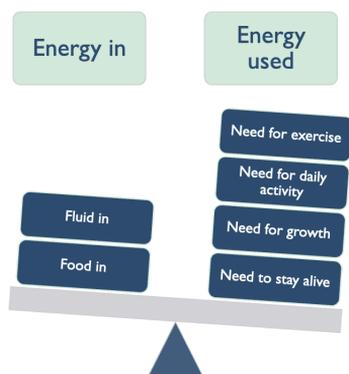


IF WE DO NOT PUT SUFFICIENT FUEL IN THE CAR, WE WON'T REACH OUR DESTINATION. YOUNG ATHLETES ARE JUST THE SAME. IF THEY DON'T EAT ENOUGH FOR WHAT THEY DO, THEY WILL BE AT GREATER RISK OF BREAKING DOWN WITH AN INJURY OR ILLNESS.

DO THEY EAT ENOUGH FOR WHAT THEY DO?

We can get energy through both food and drink sources and getting a balanced intake of all the food groups is essential. Recent studies have highlighted the importance of carbohydrates for bone health, performance and wellness.

Energy is needed for the basic survival needs of our body, for the routine things we do day to day and in sporty adolescents for growth and the sport and other activities they do.



If we do not consume or absorb enough to meet all those needs, it is termed **low energy availability** (LEA). This occurs when there is a mismatch between an athlete's energy intake and the energy expended, especially in high intensity activities. The body does not receive enough fuel to meet essential functions required by the body to maintain hormonal balance, optimal health, growth and performance.

ENERGY AVAILABILITY (EA)

Energy availability (EA) occurs on a continuum, meaning athletes at different phases of training or development can fluctuate between normal or low energy availability. The body can adjust to brief fluctuations—often seen during intensified training blocks—with minimal or reversible effects. If low energy availability is prolonged, it can become problematic and athletes become at risk of developing adverse performance or health outcomes.

LOW ENERGY AVAILABILITY (LEA)

Low energy availability can occur either due to:

1. Decrease in energy intake for the same level of exercise
2. Increase in volume or intensity of exercise creating increase energy expenditure without an increase in energy intake.

Either route means you are not getting enough fuel for the level of activity you do. An athlete can have normal energy availability but have low carbohydrate availability. This can still have an impact on injury risk and performance so whilst some adults may advocate following a low carbohydrate diet this is not advised for youth athletes.

WHO MIGHT BE AT RISK OF LEA

To understand who might be at risk of LEA, consider these two 14 year old athletes. They have developed low back pain and both have experienced a recent spike in intensity and volume of activity.

The male athlete is a soccer player and has had a recent rapid growth spurt. He misses breakfast as he gets up too late to eat on school days. He plays sport at school during his lunch break and by the time practice is over he is rushing to get to lessons and grabs what he can to eat, but often that is very little. He is training on empty.

The other child is a female dancer who was recently adopted a low carbohydrate diet and started a high intensity exercise programme with a desire to lose weight. The child had gone through puberty a year previous but in the last 2 months since the diet began she has stopped having periods.

Both children are not fuelling adequately for what they do but for different reasons. One is intentionally or consciously restricting energy intake and one is unaware of just how much energy they need to perform and the impact of skipping meals.

UNINTENTIONAL LEA

Our male athlete is totally unaware that they need more fuel intake to support growth, health and performance. Younger athletes often go hard in their efforts to get selected and improve, regularly pushing themselves at 100% but not always fuelling adequately or scheduling sufficient recovery days. During “high intensity output–low energy input” situations youth athletes can develop low energy availability.

Other causes of unintentional low energy availability include dietary needs such as those with food intolerances, those with digestive disorders such as celiac disease, vegans and children who are fussy eaters who may have to work harder to meet their nutritional energy demands and may not absorb nutrients.

UNINTENTIONAL LOW ENERGY AVAILABILITY

- Lack of awareness
- Growth spurts
- High intensity effort
- Vegan
- Fussy eater
- Food intolerances
- Digestive disorders



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INTENTIONAL LOW ENERGY AVAILABILITY



- Sport & dancers
- Social media
- Body image
- Body composition testing
- Weight categories
- Peer or coach pressure

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INTENTIONAL LEA

The young dancer is intentionally and consciously restricting energy intake and critically here, missing vital carbohydrate energy sources from their diet in the belief that this may lead to improvements in performance. In their desire to improve, some athletes may become addicted to exercise or become more concerned about weight gain, aesthetics or body image. Social media and societal pressures can fuel these beliefs.

There are so many confusing messages still surrounding athletes from out of date approaches, such as “lighter is faster” encouraging athletes to limit food intake, or “go hard or go home” may lead to athletes pushing themselves beyond their current capacity. Intentional LEA is commonly seen in:

- Endurance sports
- Sports where athletes have to meet weight categories such as rowing or boxing
- Sports where aesthetic appearance is judged such as dance and gymnastics.

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DISORDERED EATING

It is important to remember that not all low energy availability is a result of disordered eating, but it can be. Athletes in their desire to improve performance may become addicted to training or become more concerned about weight gain, aesthetics and body image.

Disordered eating (DE) sits on a spectrum between optimised nutrition and an **eating disorder (ED)**. Both can exist without visible weight loss and yet still impair health and performance.

Athletes may exhibit unhealthy attitudes and behaviours such as skipping meals, short-term restrictive diets, compulsive eating, anxiety around self-worth or body image and weighing ingredients but without fully meeting the criteria for an ED. This may be accompanied by an addiction to exercise and a belief that they have to earn food by exercising first.

Eating disorders are diagnosed by a medical professional using the DSM-5 diagnostic tool to identify mental health disorders, including eating disorders such as anorexia nervosa, bulimia nervosa, binge-eating disorder, and avoidant/restrictive food intake disorder.” If you are worried about your child’s eating habits, or you think you may need support to change your attitude to nutrition, please do consult your doctor as this may prevent injuries and illness that can impact your sport.



When energy intake is inadequate to meet the needs of our body for essential processes, the body thinks it is under threat of starvation. It takes measures to survive by switching into standby mode and down regulates non-essential hormonal processes such as growth hormone, and reproductive hormones such as oestrogen and testosterone. These hormones drive positive bone health, muscle growth and immunity and can therefore lead to injury and illness.

POWER SAVING MODE

This cascade of hormonal reactions can be explained in terms of an analogy. The human body in low energy availability, is like a mobile phone in power saving mode. When the phone battery reaches a critical level, it prioritises where to allocate the remaining energy. It restricts high energy usage apps such as video games ensuring that what energy is available is given to emergency actions such as texting or phoning Mum to say they have missed the bus!

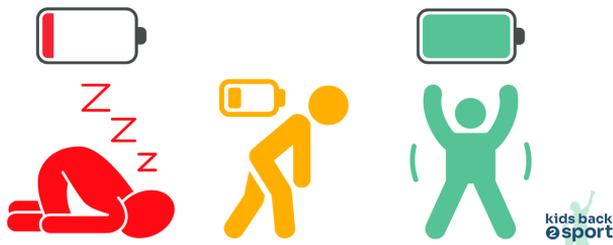
The human body works in a similar way. When there is inadequate energy available for sporting activities and essential life processes, the body initiates a series of protective mechanisms. Metabolism slows, and energy is diverted away from processes not essential for immediate survival, such as reproductive function, bone health, muscle growth, tissue repair, growth and immunity.

The only way to restore full functionality is to plug the phone in to an energy source in much the same way as children need recovery and fuelling to top up energy reserves needed for wellness and performance.

**LOW ENERGY AVAILABILITY & LACK OF RECOVERY
LIMIT THE ABILITY TO ADAPT TO TRAINING.**

**YOU TRAIN, BUT WITHOUT GETTING FITTER &
STRONGER**

POWER SAVING MODE



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It is not just low energy availability that can affect hormonal balance. Hormones are stimulated during sleep and recovery and failure to schedule recovery into your training plan can also limit the potential of the body to adapt to the training stimulus and affect performance. In addition, when children are feeling psychologically stressed, it can impact hormonal balance and despite training hard, they don't build muscles, growth may slow, and performance often drops.

Female hormone health

In female athletes, regularity of the menstrual cycle is a simple barometer of healthy hormones. When energy availability is good, girls usually experience more regular periods and conversely, if energy availability is low, periods may become irregular or stop. If the child has previously started their periods and they become irregular (less than 9 per year) or if they stop, they should see a medical practitioner to investigate the source as not all menstrual irregularity is caused by energy deficits.

If a female has not started their 1st period by the age of 15 there is a higher risk of bone stress injuries in athletes and it is recommended that the child see a doctor to do some blood tests and understand why there is a delay.

Male hormonal health

In boys who have gone through puberty, a drop in testosterone levels may result in a loss of motivational drive, a drop in libido, and fewer morning erections. Maybe grumpy, exhausted teenagers, are actually just not getting enough energy for the activity they do. Next time they are grumpy, try fuelling them better and increasing sleep and recovery and observe what happens.

In sport, athletes regularly track metrics such as heart rate. It is critical that conversations around hormone health are normalised with teen athletes so they can report changes in hormonal balance before injury or illness occur.

BONE HEALTH & HORMONES

Bone constantly goes through a cycle of bone being laid down and resorbed to make sure it adapts to the loads applied and promotes and maintains peak bone mass needed for strong, healthy bones. That is, if energy availability is adequate.

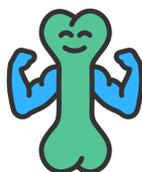
If energy availability is inadequate, **IT CAN SLOW DOWN** bone turnover with:

1. Less bone being formed
2. Lower bone mineral density
3. **Greater risk of bone stress injuries and fractures.**

IF ENERGY AVAILABILITY IS ADEQUATE

=

OPTIMAL BONE MASS MAINTAINED



Relative Energy Deficiency in Sport (REDS) or Dance (RED-D)

It is not just growth and reproductive hormones that become imbalanced in low energy availability. The term **Relative Energy Deficiency in Sport (REDS) or dance (RED-D)** has been introduced to describe the diverse adverse consequences of sustained low energy availability on all aspects of health and athletic performance (Mountjoy et al. 2015).

A condition of low energy availability affecting male and female athletes of all levels and ages affecting all body systems

There are both psychological and physical impacts to LEA. Athletes may present with digestive dysfunctions, poor healing time, low mood, anxiety, struggle to build muscle despite training, recurrent viruses and lots of injuries. Everyone is different so the presentation of RED-S varies across individuals.

WHAT ARE THE EFFECTS OF LOW ENERGY AVAILABILITY?

PHYSICAL SYMPTOMS

BONE STRESS INJURIES	RECURRENT INFECTIONS	REPRODUCTIVE SYSTEM HEALTH
CARDIOVASCULAR SYSTEM HEALTH	DROP IN PERFORMANCE	DIGESTIVE SYSTEM HEALTH
DELAYED HEALING TIME	DROP IN PROTEIN SYNTHESIS	FATIGUE



IT'S NOT ALWAYS REDS OR RED-D

What is important is that not every adolescent athlete who has a drop in performance, gets recurrent infections or irregular periods has REDs or RED-D. There are many reasons for these types of symptoms and so if a child starts to experience persistent symptoms it is worth seeing a doctor and getting some blood tests done. **REDs can only be diagnosed by a doctor** once other medical conditions have been ruled out as it's symptoms mimic other disorders such as:

- Endocrine disorders (thyroid, adrenal, diabetes)
- Gynaecological conditions
- Anaemia
- Vitamin D deficiency
- Infectious/viral illnesses such as glandular fever
- Cardiac conditions

The doctor may not be familiar with REDs so please do share this handout with them.

MANAGEMENT

The aim of treatment is to restore optimal energy availability through an increase in energy intake and a reduction in excessive energy expenditure.

For young athletes who have developed LEA unintentionally, explaining the link between inadequate energy intake for what they do and their health and performance can be enough to motivate them to fuel better, add more low-intensity training days and plan effective recovery to restore energy balance quickly.

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MANAGEMENT OF PROBLEMATIC LEA

If an athlete has developed problematic low energy availability, it can take many months to restore hormonal balance and often a year or more to restore adequate bone mineral density to enable a full return to normal training levels. A safe return to sport programme has to be planned with a clinician who understands REDs to guide safe loading levels.

The International Olympic Committee introduced a clinical assessment tool (REDs CAT2) for the evaluation of athletes suspected of having problematic low energy. It is a four coloured traffic light system to grade severity and risk categorisation and can help guide safe return to sport. This needs to be completed by a suitably trained health professional and the athlete should see a sports medicine doctor where possible. If after being assessed, the athlete has positive energy availability, and are injury free they will be given the green light to build back up training and competition gradually.

In athletes who are identified as being at greater risk of injury, their activity level may be restricted until they have restored positive energy availability and hormonal balance has been restored. A strong message for a faster recovery is to stop exercising but eat as though they were still training which can be hard for athletes who are concerned about weight gain and there may be some resistance to making changes to either diet or exercise behaviour.

In those athletes who have developed either disordered eating or have a clinical diagnosis of an eating disorder, or those who have psychological drivers resulting in low energy availability, a multidisciplinary approach involving medical, nutritional, exercise, and psychological expertise is needed to address maladaptive beliefs.

A combination of education, strict monitoring, tailored nutrition, strength training, recovery plans and support to return to play needs to be put in place.

EDUCATE THE ATHLETE

All athletes need education about the importance of fuelling for long term wellness and performance. Messages need to be reinforced that athletes need to eat a balanced diet with good portions of complex carbohydrates, fats and proteins especially at breakfast. They should never train on an “empty tank”. No food should be demonised, or feel like it must be earned and banter should be avoided that focuses on weight, size or looks.

What is important is that athletes understand that their normal breakfast, lunch and dinner meals are what is needed by healthy individuals just to maintain their **survival battery** for essential bodily functions. Athletes also need to take on board adequate energy in addition to those 3 meals a day to support energy needed for training and competition. **They need to fill their training battery too.** What is pivotal, is that they don't borrow from their survival battery for their sporting activities and leave the survival battery depleted and unable to maintain wellness and performance. This can help them understand that they need to vary how much they eat each day depending on the volume and intensity of activity.



Fuelling cars and kids have many similarities. If we play hard and fast, or drive hard and fast we burn through more fuel. However, parents rarely consider adjusting the energy input on days when children are competing at higher intensity or for more prolonged bouts of exercise. During growth spurts or busy weeks, pack an extra energy rich sandwich for break time and ensure consistent intake throughout the day, providing snacks to eat before and after school clubs and activities.

CREATING POSITIVE ENERGY BALANCE IN POSITIVE ENVIRONMENTS

It is all about finding the right balance. Too much stress on the body is not sustainable and affects performance. A lot of what happens to an athlete can be out of their control such as results, weather, equipment, and growth, however their fuel intake combined with their attitude to recovery is something which is within their control. Once they learn to appreciate how effective optimal fuel and recovery can be on enhancing their athletic ability and performance, they may feel better able to cope when faced with things they cannot control.

Supporting athletes to plan training, & recovery days and to listen to their body when it is struggling is important in maintaining optimal wellness & performance. They can be encouraged to look out for symptoms that they are not coping with current training loads, such as:

- Recurrent viruses & sore throats
- Niggly injuries
- Lack of motivation
- Fatigue
- Irregular periods
- A drop in performance despite training

If your child develops the early symptoms of REDs, or you as an athlete are worried about your energy levels, please seek medical advice from a Sports Medicine Doctor, a Sports Nutritionist or an MSK Physiotherapist who should then be able to sign post you to the next steps in diagnosing and managing the symptoms.

There are many excellent resources available to help you learn more:

[The Reds project](#)

[Red in Sport](#)

[Performance canteen](#)

[IOC Statement on REDs](#)

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IF YOUR PAIN DOES NOT SETTLE WITHIN A FEW WEEKS OR AFFECTS YOUR SLEEP, SEEK THE HELP OF A QUALIFIED HEALTH PROFESSIONAL.

Angela Jackson was a young athlete who had an injury that ended her sporting dreams. That has fuelled a passion to deliver high-quality diagnosis and treatment for all young athletes in a career as a physiotherapist spanning 35 years. She has helped athletes of all ages and abilities achieve their potential including supporting her own 2 children to international success.

For almost two decades, she has worked as the Physiotherapist to the Cheshire Cricket Board and advises Premier League Football Academies across the globe.

As a passionate educator, Angela lectures internationally, is the author of multiple online courses, and advocates for a specialised approach to rehabilitating injured young athletes through the platform, "Kids Back 2 Sport."

LUCY LAWTON (NEE GILLBANKS)

Lucy Gillbanks was a light weight rower who competed internationally and had symptoms of REDs. Since recognising the symptoms in herself, she then went onto to study REDs at Oxford University and has published multiple academic papers on the topic.

Lucy continues with sports like rowing, running and skiing now without any symptoms of REDs.

Lucy works as a physiotherapist guiding athletes of all ages with their rehab and symptoms of REDs. She is listed on the Kids Back 2 Sports directory of therapists.

IMPACT OF LEA

Think about the needs of this zebra facing threat from a chasing lion. What systems does it need to survive, and which systems are non-essential?



For those parents who have helped out with biology homework, you will be familiar with the acronym MRS GREN. Think about these bodily systems and tick off in your head which ones are essential for short term survival and which ones are not.

MOVEMENT
RESPIRATION
SENSITIVITY

GROWTH
REPRODUCTION
EXCRETION
NUTRITION

The zebra takes measures to prioritise energy for systems required for survival including the brain, the heart and lungs and muscles to run away. but at this time, digesting breakfast and licking wounds do not come high on the list of priorities.

During times of low energy availability, the body switches into standby mode and down regulates non-essential hormonal processes such as growth hormone, reproductive hormones such as oestrogen and testosterone which drive bone health, muscle growth and immunity.

HOW DO WE RECOGNISE THE SIGNS OF THE BODY EXCEEDING IT'S CAPACITY?

**NIGGLY
INJURIES**

**PERIODS
STOP**

**SLEEP
QUALITY**

**RECURRENT
SORE THROATS**

**LOW
MOTIVATION**

**STRESSY &
GRUMPY**

FATIGUE

**DROP IN
PERFORMANCE**

