NUTRITION AND SPORTS SUPPLEMENTS IN RUNNERS

Run Stronger, Recover Faster: The Ultimate Nutrition Guide For Injury Free Training and Peak Performance

By Ronnie Patel (Pharmacist and proud member of Dulwich Park Runners)

OVERVIEW

- What are “supplements”?
- Energy systems in sports
- Red flags in sports nutrition
- Injury prevention and physiology
- Physiology
- Peak race day performance
- Post race day recovery
- Final thoughts
- Q and A

WHAT IS A DIETARY SUPPLEMENT?

A dietary supplement is defined by the UK Food Standard Agency as 'any food the purpose of which is to supplement the normal diet and which is a concentrated source of a vitamin or mineral or other substance with a nutritional or physiological effect, alone or in combination and is sold in dose form' [1].

These can include:

- Vitamins and minerals
- Amino acids
- Essential fatty acids
- Fibre
- Herbal/Plant extracts

They are intended to correct nutritional deficiencies which cannot be achieved by diet

"They are not medicinal products and as such cannot exert a pharmacological, immunological or metabolic action. Therefore, their use is not intended to treat or prevent diseases in humans or to modify physiological functions"

DID YOU KNOW?

The correct nutrition can:

- Prevent injury
- Provide us with more energy
- Aid recovery
- Help us heal faster
- Promote us with better mental health and well being

EAT WELL = RUN WELL = BE HAPPY

SPORTS NUTRITION BACKGROUND

- The general principle of sports nutrition is the science of hydration and fueling before, during and after intense exercise
- If carried out correctly it can help promote training and overall performance
- If ignored – it can negatively training, reduce performance and affect mental well being.
- Key principles of sports nutrition:
  - Hydration
  - Fuel muscles
  - Promote recovery

“A GOOD DIET DOES NOT MAKE AN AVERAGE ATHLETE GREAT, BUT A POOR DIET CAN MAKE A GREAT ATHLETE AVERAGE”

Dr. David Costill (Exercise Physiologist).

CALORIES

Calories are a measurement of energy in nutrition, which we expend during intense exercise.

In absence of calories our bodies burn fat and muscle to enable cell health and organ repair..

There are two systems that provide our bodies with energy:

Aerobic (with oxygen):

- For low impact and resting energy – ie zone 2 (easy running). Relies on fat and complex carbohydrates
- Waste products – Carbon dioxide and water (easily removed by lungs)

Anaerobic (without oxygen)

- Relies on ATP and glucose for more intense exercise – ie sprint work
- Waste products – lactic acid which accumulates causing muscle fatigue.
- Lactic acid is excreted via kidney which can vary according to hydration.

AEROBIC VS ANAEROBIC ENERGY SYSTEMS

AEROBIC VS ANAEROBIC

This is the predominant system used for races longer than 3 minutes. This system produces energy via OXYGEN. The aerobic system doesn't create nearly as much power as other systems, but its capacity is virtually endless

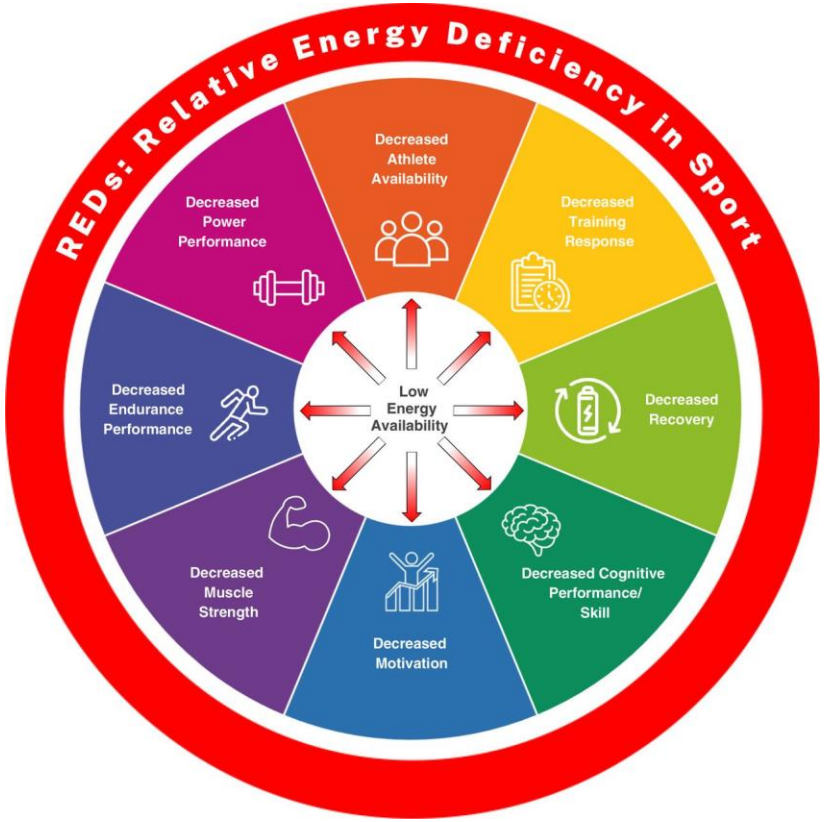
This is the predominant system used for races less than 3 minutes. This system does NOT need oxygen to produce energy. It uses energy stored in the cells. There are limited amounts of stored energy in the cells, which is why you can only use this system for very short periods of time

HEART RATE TRAINING ZONES

HR ZONES		ENERGY SYSTEM
90 - 100%	You're pushing yourself to your limits	Immediate
80 - 89%	Breathless, with difficulty saying more than 2-4 words in a row.	Anaerobic & Aerobic
70 - 79%	Breathless, but able to speak a sentence of 4+ words.	Aerobic
60 - 69%	Muscles are warmed up and light sweating is likely.	Aerobic
50 - 59%	Exercise at this level is enjoyable and light.	
0 - 49%	This is how you normally feel when you're resting.	

RELATIVE ENERGY DEFICIENCY IN SPORT (RED-S)

- Huge “red flag” in sports
- It is a syndrome in which there is a significant imbalance between energy consumption and expenditure in athletes
- Often poor leadership in sports may incorrectly advise their athletes that they are more likely to win competitions when they have an extremely lean body type.
- RED-S is a serious illness which can result in lifelong health consequences and can potentially be fatal.
- Estimated to affect 20% of all professional athletes[2].



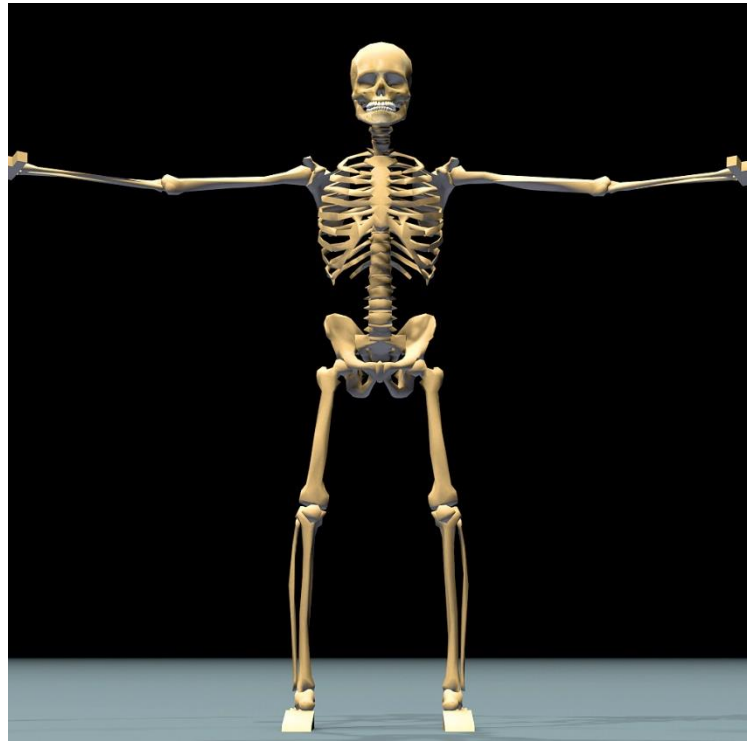
INJURY PREVENTION

- As runners we are at high of injury. In general running is a “high impact” sport and we push ourselves to extremes.
- Our muscles, ligaments, bones, tendons all play a vital role in our day to day lives.
- A balanced diet is encouraged, however for us runners who are very active it is important to get this correct to ensure we minimise damage and aid recovery in the best possible way.

BONES, LIGAMENTS, TENDONS, MUSCLES…

Bones:

- Calcium rich structures that accounts for 12-15% of total body weight.
- Roles:
  - Support and protects organs from external damage
  - Lever muscles enabling movement when they contract
  - Contain marrow which produces key blood component (ie red blood cells)
  - Mineral storage



BONES, LIGAMENTS, TENDONS, MUSCLES…

Ligaments

- Fibrous bands which connect bones together
- Roles:
  - Provide support to joints – ie when you sprain an ankle its normally ligament damage.
  - Stabilises joints by preventing excessive movement – ie can you bend your finger back?
  - Essential for maintaining skeletal structure

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BONES, LIGAMENTS, TENDONS, MUSCLES…

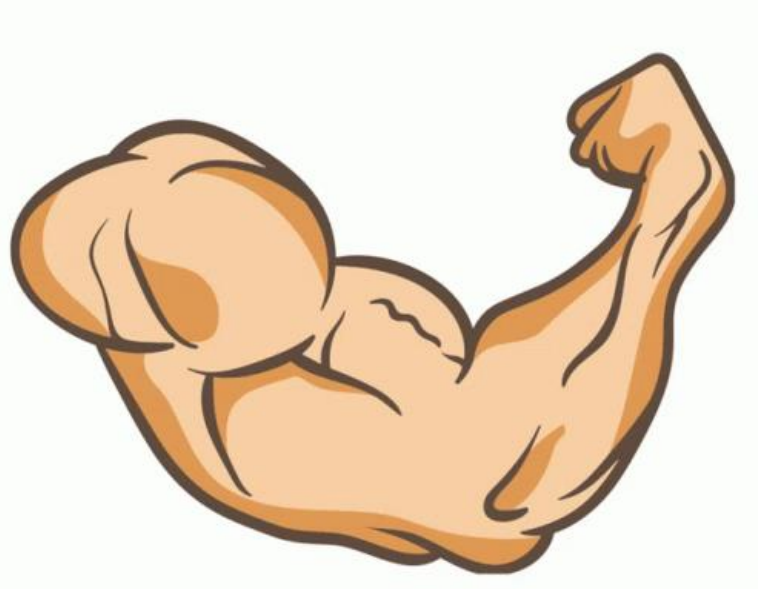
Tendons

- Roles:
  - Connects muscles to bones
  - Absorb shock – common in running especially if you have worn or unsupported shoes
  - Provide stability by keeping muscles and bones aligned during exercise
  - Common issue in runners is tendonitis – which is when the tendon is damaged and inflamed causing pain

BONES, LIGAMENTS, TENDONS, MUSCLES…

Muscles

- Essential to movement and always in use
- Roles:
  - Contract to move the bones, ligaments and tendons
  - The heart is the most important muscle in the body which is essential for pumping oxygen and blood round the body
  - Helps with temperature regulation and contraction generates heat.
  - Most common site of injury



SUPPLEMENTS AND NUTRITION ROLE

- The correct dietary supplementation and nutrition is essential in keeping these structures healthy.
- All these structures; bones, ligaments, tendons and muscles weaken with age.

Structure	Changes with age
Bones	Bone density decreases (particularly women) – high risk of fractures
Ligaments	Lose elasticity – reduces flexion and increases risk of tears.
Tendons	Lose flexibility, as collagen production reduces with age – increases risk of tendonitis
Muscles	Mass decreases (after age of 30) – reduce strength – risk of falls and injury

ESSENTIAL SUPPLEMENTS TO REDUCE RISK OF INJURY

Disclaimer – no known way to 100% prevent damage, but the correct supplementation can significantly reduce the risk to these 4 essential structures

There are some known methods to prevent injury in addition to nutrition.

- **Warm up and cool down**
- **Gradual progression** and consistency with training – follow 10% rule
- **Proper footwear** – worn or inappropriate footwear can affect biomechanics and subsequent injury – rotate footwear and replace after 500miles!
- **Strength training** – Improvements in joint stability and prevents muscle decline
- **Listen to your body – rest and recovery**
- **Hydration** – part of nutrition. Poor hydration reduces ability of muscle to be flexible, temperature regulate, and causes cramping.

TALK TO CLUB COACHES FOR FURTHER ADVISE ON THIS

NUTRITION AND INJURY PREVENTION

- Nutrition plays a key role in preventing damage to bones, ligaments, tendons and muscles

- **The aim of nutrition in injury prevention is:**
  - Promote strong bones by strengthening and prevent fractures
  - Enhance muscle strength
  - Reduce excess inflammation
  - Support joint health
  - Enhance recovery

So, what is available?

VITAMIN D AND CALCIUM

- Around 40% of bone mass is made up of calcium.
- This mineral keeps bones strong and prevent declination with age

Vitamin D:

- Regulates calcium and phosphorus (makes up 15% of bone structure)
- Helps absorb dietary calcium and phosphorus into the bones to maintain strength
- Prevents bone diseases like rickets and osteoporosis
- Has a role in immune system to boost response
- Dietary sources:
  - Eggs, salmon, milk – accounts for 10% in humans
  - Sunlight – accounts for approx. 90% in humans
- United Kingdom – has limited sunlight and is diverse – predisposing us to deficiency.
- The UK government recommends “all adults and children over age of one should consider a supplement“

VITAMIN D AND CALCIUM

Endurance athletes

There have been multiple studies which have promoted vitamin d supplements in athletes

One such study found that around 80% of subjects (mean age of 43 years old), who had experienced a stress fracture were vitamin d deficient[3].

It is estimated that professional athletes require 2000 – 6000 units of vitamin d a day to prevent risk of injury – this includes how much we get from the sun and from diet.

Without vitamin d – calcium and phosphate does not absorb and bones do not strengthen

VITAMIN D AND CALCIUM

Endurance athletes

Calcium

- Essential for bone nutrition (as discussed)
- Muscle contraction
- ATP (energy generation)

-Whilst these are limited, recommendations for calcium intake vary according to age.

Age Group	Calcium (mg/day)	
	Male	Female
12–18 yrs	1300	1300
19–50 yrs	1000	1000
51–70 yrs	1000	1300
>70 yrs	1300	1300

- The UK has no specific recommendations for calcium intake for runners but above is recommended by Australia's National Health and Medical Council[4].
  - Similar diversity
  - Varied weather

- This can be achieved by diet but if not supplements are available.

COLLAGEN

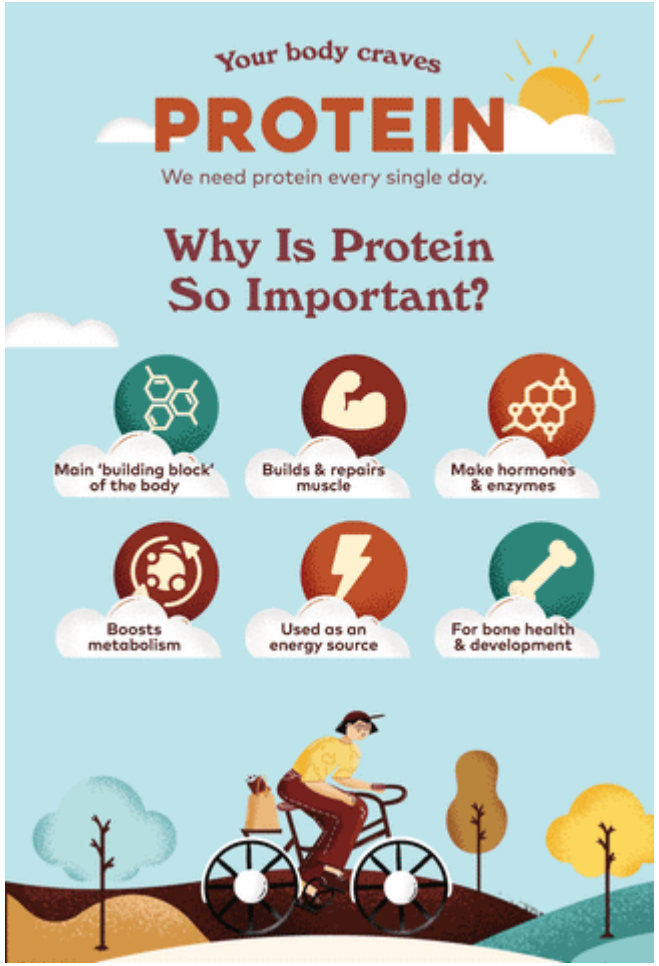
- Collagen is a protein based molecule which provides a building block of skin, muscle, ligament and tendon rebuild.
- Accounts for 30% of body's protein.
- Maintains flexibility of structures which decline with age
- Research shows that collagen supplementation decreases post-workout pain from osteoarthritis and strengthens tendons, ligaments, and joints to improve range of motion and flexibility.
- Is naturally generated in body (but this declines with age)
- Whilst evidence is limited studies suggest 15-20g of collagen supplementation a day.
- Can be achieved by diet or supplementation.
- Vegan or vegetarian diets may be restricted but there are quite a few options with aid collagen production.

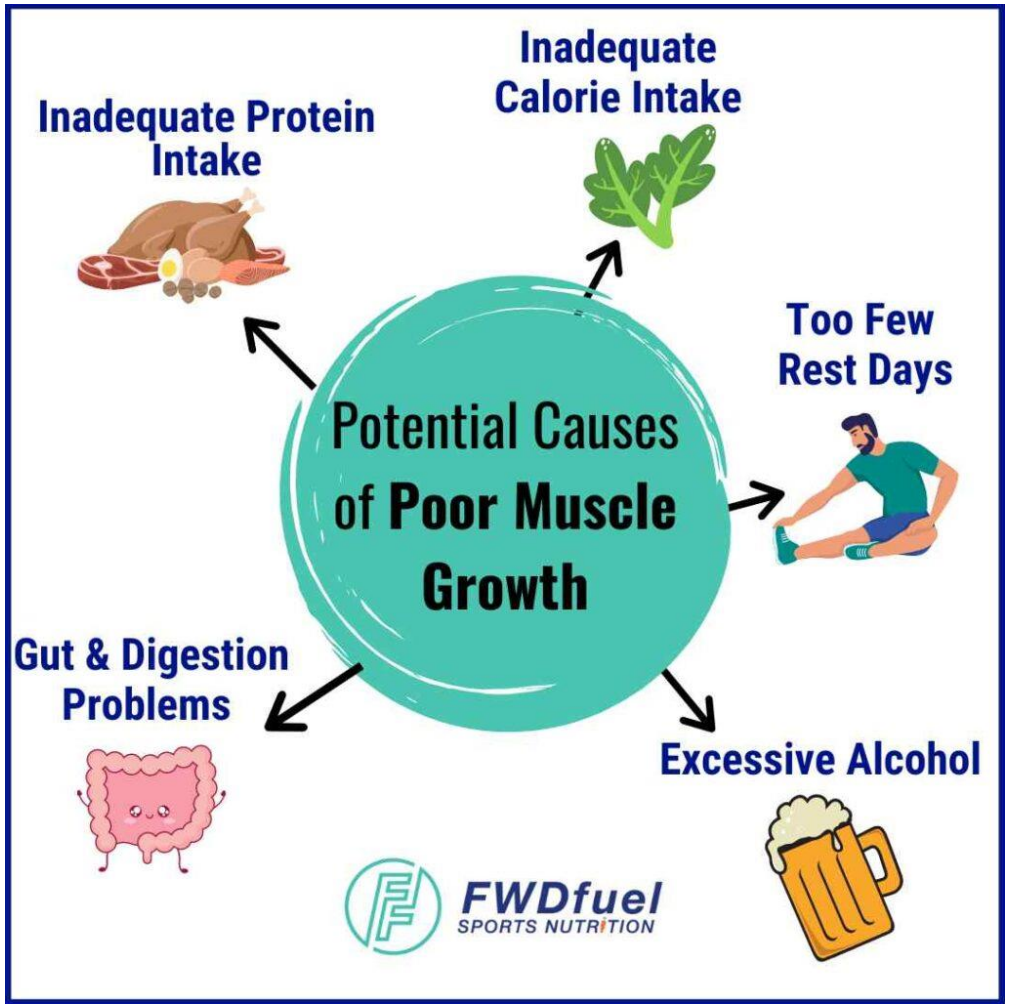
FOODS HIGH IN COLLAGEN PROTEIN			
FOOD	COLLAGEN PER SERVING	SERVING SIZE	NOTES
BONE BROTH	8-10 G	1 CUP	MUST HAVE 10-12 TOTAL PROTEIN PER 250 ML.
GELATIN	10 G	10 G	
PORK RINDS	10 G	28 G	DEEP FRIED PORK SKIN.
SALMON	6.5 G	170 G	COOKED SOCKEYE SALMONE IN OVEN (1 filet).
PORK SKIN	5 G	14 G	HERRING, MACKEREL IN A CAN WITH SKIN + BONES.
SARDINES	5 G	150 G	HERRING, MACKEREL IN A CAN WITH SKIN + BONES.
CHICKEN SKIN	4 G	14 G	
PORK SPARE RIB	3.5 G	85 G	MUST BE SLOWED BRAISED.
BEEF SHORT RIB	3 G	85 G	MUST BE SLOWED BRAISED.
BEEF OXTAIL	2.5 G	75 G	
CHICKEN WINGS	2.5 G	105 G	WING MEAT AND SKIN, RAW (1 wing).

CREATINE

- One of the most studied sport supplements
- Don’t let the name fool you – it has nothing to do with the kidney!
- It is a naturally occurring dietary compound found in red meat and fish, and has a role of providing an additional energy source in the muscles.
- It regenerates “ATP” which provides energy particularly in short bursts.
- For athletes, it increases muscle mass, by promoting water retention, which keeps muscles hydrated to prevent injury and overstretching.
- After intense exercise – it replenishes depleted ATP quickly and aids rapid hydration.
- Generally, 5g is recommended dose after workouts and on a daily basis (even when not working out)
- Important – hydration is very important

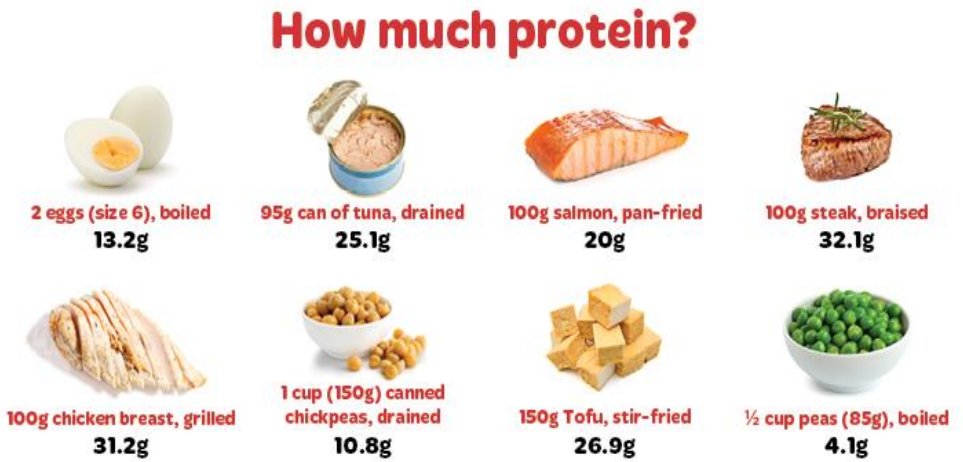
PROTEIN AND BRANCHED CHAIN AMINO ACID





PROTEIN AND BRANCHED CHAIN AMINO ACID

- Protein is abundant in diet and plays a critical role for athletes for performance and injury prevention
- After workouts the muscle sustain microtears, which when repaired lead to growth.
- Protein and amino acids are the building blocks for muscular and cellular repair.
- Muscle hypertrophy will aid performance on race day.
- As they state in beginners “rest days are just as important as training days” this is because repetitive microtears will not lead to hypertrophy and result in injury.
- Use varies but generally protein supplementation is recommended 30min to 2 hours for optimal growth and recovery
- Recommended dose 0.5-1g/kg per day in total (approx. 20g-30g post workout is recommended depends on intensity)
- Diet should be sufficient but supplements available..



MAGNESIUM

Many beneficial roles in athletes:

- Helps bone regulation by working with calcium and vitamin d to maintain density.
- Has anti-inflammatory properties to aid recovery.
- Works centrally (in the brain!) to regulate mood and brain function – important to stress and sleep which subsequently aids recovery and muscle synthesis.
- Most importantly, regulates muscle contract and relation.
- Regulates electrolytes – i.e. if you are deficient in magnesium you are likely to be deficient in other electrolytes

Adequate supplementation enables athletes to train harder, reduce injury, recover to aid performance.

MAGNESIUM

Dosing recommendation vary but on average the recommendation for magnesium for athletes is as follows (approx. 10-20% for non athletes), before bed.

- Women – 320mg
- Men – 420mg

- Dietry sources are abdundant – but supplements are available
- Note – available in spray form – no evidence of absorption via skin …

OMEGA 3 FATTY ACIDS

- Primarily founds in fish and certain plant sources
- Has multiple benefits for athletes:
  - Anti-inflammatory – essential for continuous training by improving recovery:
    - Reduces excess cytokine (inflammatory marker production).
  - Cardiovascular
    - Transports triglycerides (dietary “bad” fats), which improves circulation of blood and oxygen
    - Essential for VO2max (oxygen uptake efficiency) and recovery
    - Faster recovery/rebuild
  - Muscle Synthesis
    - Improves muscle sensitivity to amino acids form more efficient rebuild
    - Boosts protein synthesis.

OMEGA 3 FATTY ACIDS

- Evidence of improved performance in athletes
  - Limited
  - Some trials with obvious limitations have shown a marked VO2max after 12 weeks following supplementation with omega 3 fatty acids

- Various studies have recommended 1-2g of omega 3 (or equivalent) for “significant athletic improvement”.

SLEEP

The Sleep Foundation, recommends athletes are recommended to get 7 hrs (at least) to 9 hrs (optimal).

Benefits of optimal sleep in athletes…

Muscle repair and recovery:

- Deep sleep triggers release of the growth hormone which aids muscle repair, tissue growth and overall recovery

Energy replenishment:

- Metabolises dietary carb sources to replenish glycogen stores

Immune system

- Maximal immune function “bed rest is best”.
- Sickness interferes with optimal training..

Improved reactions

- Reduce risk of tripping, failing…

Plenty of herbal supplements to aid sleep; ashwagandha, valerian root, magnesium, lavender oil, camomile tea……

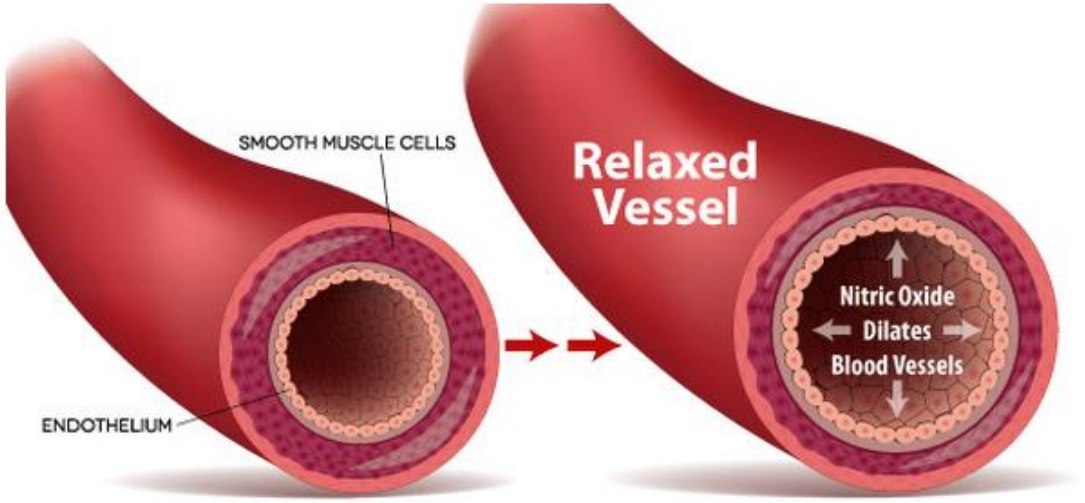
PERFORMANCE AND NUTRITIONAL SUPPLEMENT

THERE IS NO MAGIC SUPPLEMENT…

- To get a PB train hard…
- However small gains can help..
- Certain dietary changes can help your body deliver oxygen more efficient (which we have touch on briefly).
- These are known as “nitrates”.
- In the medical field there are medications which “dilate blood vessels” in heart conditions..
- There are nutrition sources that can do this (to a much smaller degree) – which means a better performance on race day for oxygen delivery

DIETARY NITRATES - BACKGROUND

- Multiple studies have proved that dietary nitrates can could lower high blood pressure [5].
- They also found that dietary nitrates had similar effects.
- Their studies showed that nitrates could lower blood pressure by increasing nitric oxide, which acts as a vasodilator.
- Following this a further study in 2009, at the University of Exeter demonstrated that beetroot juice reduced the oxygen cost of exercise and improved cycling performance. That study showed a significant reduction in energy demand—around 16%.



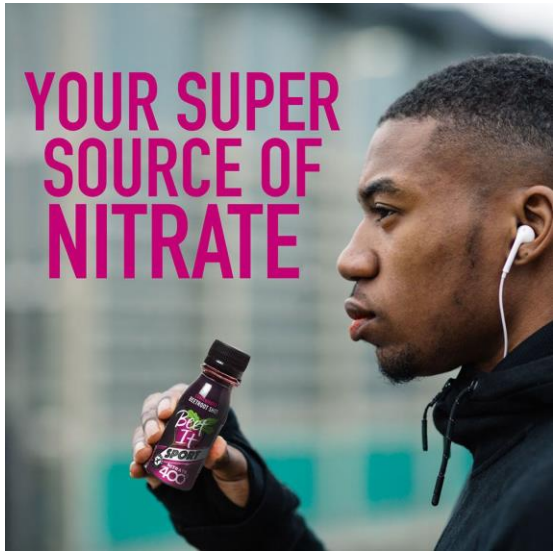
DIETARY NITRATES - BACKGROUND

- The study studied with eight men with similar VO2max levels (aged 19-38), who were given 500ml per day of organic beetroot juice for six consecutive days before completing a series of tests, involving cycling on an exercise bike. On another occasion, a “placebo group” were given a placebo of blackcurrant cordial (taste masked) for six consecutive days before completing the same cycling test [6].
- The result: The experimental group were in fact able to cycle for an average of 11.25 minutes in total (about 92 seconds longer), than when they were given the placebo (a total of 2% improvement).
- Further result found the experimental group had an average lower blood pressure than the placebo group

It was concluded that after testing six days of dietary nitrate supplementation significantly reduced the oxygen cost of exercise by 5% and delayed the onset of fatigue by 16%

DIETARY NITRATES - BACKGROUND

- The studies involved 400mg of dietary nitrate which suggest athletic performance improvement on daily basis
- Sometimes more convenient to get in a form of a supplement than diet..
- Multiples preparations available…



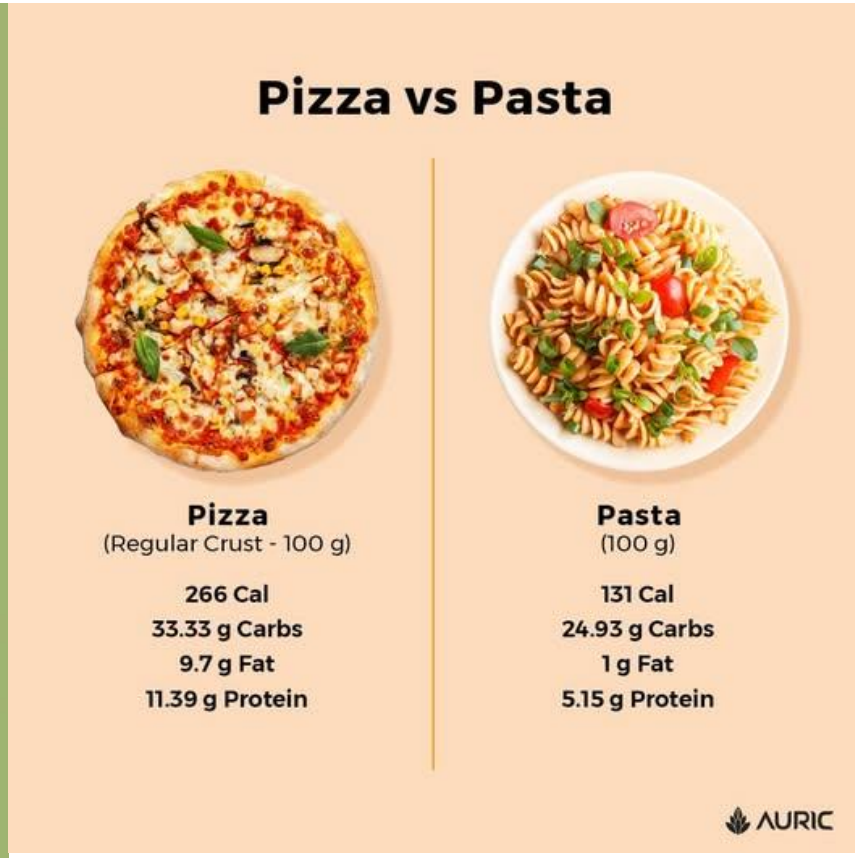
Nitrate Content of Vegetables		
Vegetable	**Serving Size**	**Nitrate (mg)**
Rhubarb	1 cup diced	343
Butterleaf Lettuce	2 cups shredded	220
Agurula	2 cups	192
Salad mix, beet greens	2 cups leaves	135
Swiss Chard	2 cups leaves	109
Beets	.5 cup slices	94
Spinach	2 cups leaves	47
Cilantro	1 cup leaves	40
Basil	.5 cup leaves	22
Broccoli	1 cup chopped	18
Potato	.5 cup diced	8

SOURCES: The EFSA Journal (2008) 689, 1-79. Serving Size Information from USDA, 2011.

PRE-RACE FUELING

It is essential to ensure your body's carbohydrate stores (stored as glycogen) in the liver/muscles are replenished before race day. This is known as carb loading

- Normally 3-4 days before marathon day and during the taper complex carbohydrate intake is increased to 10g/carb/kg/day.
- Increase fluid intake to help store carbohydrates
- Weight gain expected but this is mostly water weight..



IN RACE FUELLING

For an endurance event (for example a marathon), both anaerobic and aerobic energy systems are utilised, relying on both carbohydrates (long complex chain of sugar molecules which need to be broken down) and glucose (simple carbs).

- During very hard zone 4-5 exercise carbohydrates are depleted at a rate of 3-4g per minute
- Our body's can store enough glycogen stores in our muscles and liver for roughly 1.5-2hours
- In light of this we should aim to replenish 30-40g per 30 mins (based on depletion)…

IN RACE FUELLING

POST RACE FUELLING

- Even after running your best race…depleted glycogen stores will need to replaced with carbohydrates

- Dieticians advise an immediate replacement with carbohydrates of approximately 1g/kg within the first 30-60minutes, followed up carbohydrate rich meals though-out the day..

Hydration:

- Zone 4 (normal race pace for most) is both aerobic and anaerobic, which means lactate accumulation.

- Ensure urination every 4 hours to eliminate and prevent kidney damage and complications

- Remember your body has lost a lot of electrolytes through sweating so make sure adequate electrolyte intake also

FINAL CONSIDERATIONS

Although evidence is limited – i.e. trial data certainly has its limitations and is open to critical appraisal, we must consider that these are nutritional supplements and not medicines

Safety profile is relative safe (unless you have intolerances) and shouldn't interact other medication – **however always best to check with a healthcare professional..**

What may work for one runner may not work for another – so trial during training and remember – **NOTHING NEW ON RACE DAY**

Whilst a balanced diet is preferred it is not always convenient.

If in doubt about nutritional content check the label!

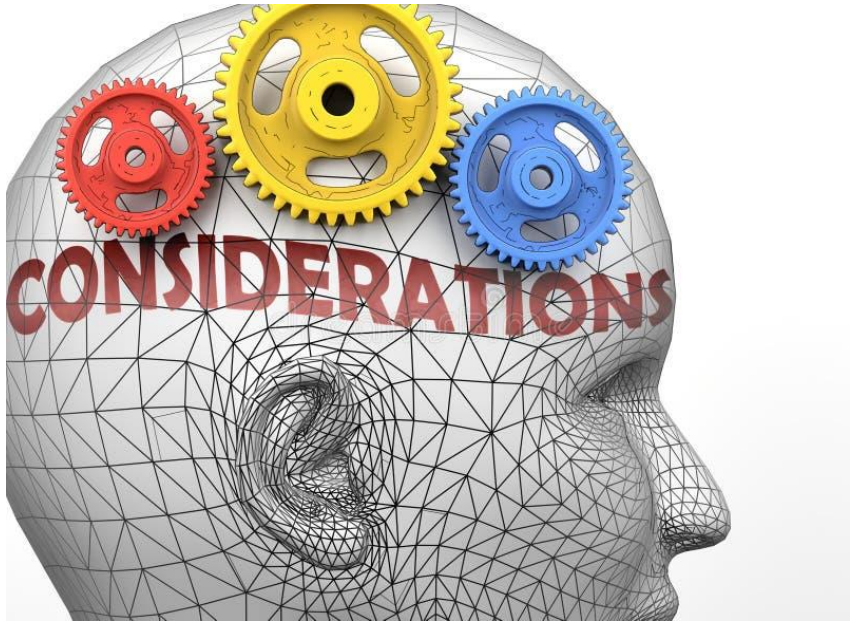
Nutrition Facts

16 servings per package

Serving size	**1 oz (28g)**
Amount Per Serving	
Calories	**160**
	% Daily Value*
Total Fat 12g	**15%**
Saturated Fat 2g	**10%**
Trans Fat 0g	
Cholesterol 0mg	**0%**
Sodium 0mg	**0%**
Total Carbohydrate 9g	**3%**
Dietary Fiber <1g	**3%**
Total Sugars 2g	
Includes 0g Added Sugars	**0%**
Protein 5g	
Vitamin D 0mcg	0%
Calcium 10mg	0%
Iron 1.9mg	10%
Potassium 190mg	4%
Magnesium 85mg	20%
Zinc 1.6mg	15%

* The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

INGREDIENTS: organic Cashew flour



SUMMARY

- The right nutrition is essential for all of us athletes, and helps us perform at our best
- Minimises harm to our mental and physical health
- Maintains our enjoyment for the sport and helps us strive for higher goals
- Any concerns talk to your pharmacist, doctor or dietician
- Any questions – reach out ☺

"A GOOD DIET DOES NOT MAKE AN AVERAGE ATHLETE GREAT, BUT A POOR DIET CAN MAKE A GREAT ATHLETE AVERAGE"

FURTHER READING

1. Food Standards Agency. (July 2024). *Food supplements*. [Online]. . Available at: https://www.food.gov.uk/business-guidance/food-supplements [Accessed 25 January 2025].

2. Dudgeon, Emily. (2019). Relative energy deficiency in sport (RED-S): recognition and next steps. British Medical Journal. 1(1). [Online]. Available at: https://blogs.bmj.com/bjsm/2019/04/22/relative-energy-deficiency-in-sport-red-s-recognition-and-next [Accessed 25 January 2025].

3. Millward D, Root AD, Dubois J, Cohen RP, Valdivia L, Helming B, Kokoskie J, Waterbrook AL, Paul S. Association of Serum Vitamin D Levels and Stress Fractures in Collegiate Athletes. Orthop J Sports Med. 2020 Dec 9;8(12):2325967120966967. doi: 10.1177/2325967120966967. PMID: 33816638; PMCID: PMC8008136.

4. AIS SPORTS SUPPLEMENT FRAMEWORK. (2021). *CALCIUM SUPPLEMENT*. [Online]. Australian Institute of Sport. Last Updated: December. Available at: https://www.ais.gov.au/__data/assets/pdf_file/0003/1037685/Calcium-Supplement-fact-sheet.pdf [Accessed 25 January 2025].

5. Kapil et al. (2013). Dietary Nitrate Provides Sustained Blood Pressure Lowering in Hypertensive Patients: A Randomized, Phase 2, Double-Blind. *Hypertension*. 65(2). [Online]. Available at: https://doi.org/10.1161/HYPERTENSIONAHA.114.04675 [Accessed 25 January 2025].

6. Bailey SJ, Winyard P, Vanhatalo A, Blackwell JR, Dimenna FJ, Wilkerson DP, Tarr J, Benjamin N, Jones AM. Dietary nitrate supplementation reduces the O2 cost of low-intensity exercise and enhances tolerance to high-intensity exercise in humans. J Appl Physiol (1985). 2009 Oct;107(4):1144-55. doi: 10.1152/japplphysiol.00722.2009. Epub 2009 Aug 6. PMID: 19661447.

7. Van Loon LJ. Role of dietary protein in post-exercise muscle reconditioning. Nestle Nutr Inst Workshop Ser. 2013;75:73-83. doi: 10.1159/000345821. Epub 2013 Apr 16. PMID: 23765352.

Thank You For Listening
Any Questions ??