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Fundamental principles of sports nutrition

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Goal: optimize performance and health through targeted fueling, hydration, and recovery.

Key topics: energy and macronutrients, nutrient timing, REDs prevention, hydration, supplements.





How important is nutrition?

Nutrition as a factor of health It allows the athlete to be able to exercise, stay healthy and not get injured

Nutrition for athletes Recommendations of clinical sports nutrition

Prof. Ron Maughan, Lecture; Energy balance and body composition, IOC Diploma in Sports Nutrition





An appropriate <u>nutritional strategy</u> allows us to improve adaptations to physiological stimuli or stress (exercise!) through strategically adjusted intakes (quantity + timing) of key nutrients, resulting in several benefits:

+ We maintain health and well-being

+ We support regeneration

+ We enable the growth and development of young athletes

+ limprove body composition (gain/maintenance of muscle mass, fat loss)

+ We improve physical performance, strength and skills

It is easier to achieve sports and other personal goals

Is running stressful??



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Appropriate nutritional strategy supports optimal adaptations to exercise and prevents potential negative consequences



Principles of a quality nutritional strategy

Supported by scientific evidence and recommendations (validated literature)

Tailored to the individual's needs (type of sports activity, age, gender, health specifics, work and other daily activities...)

Monitored by relevant **biomarkers** (e.g. running results, lactate measurements, aerobic capacity, body composition measurements...)



Hierarchy of (sports) nutrition



Specialized sports nutrition

Macronutrients and timing of nutrient intake

Optimal energy availability









THE AMOUNT OF ENERGY CONSUMED THAT REMAINS IN THE BODY **AFTER PHYSICAL ACTIVITY FOR PHYSIOLOGICAL PROCESSES** – cellular function, thermoregulation, growth, reproduction, immunity, etc.



The concept of LOW energy availability (LEA)

LEA is any **mismatch between dietary energy intake** and **energy expended in exercise** that leaves the body's total energy needs unmet, that is, there is **inadequate energy to support the functions required by the body to maintain optimal health and performance**.

 $EA = \frac{energy intake, EI(kcal) - exercise energy expenditure, EEE (kcal)}{fat free mass, FFM (kg)}$



What happens in the state of LEA?



The body **conserves energy** by reducing expenditure on processes that are not essential for short-term survival:

- cellular activity (regeneration!),
- thermoregulation,
- immunity,
- growth,
- reproduction

to compensate for the negative energy availability!





Co-funded by the European Union Mountjoy, Margo, et al. "International Olympic Committee (IOC) consensus statement on relative energy deficiency in sport (RED-S): 2018 update." *International journal of sport nutrition and exercise metabolism* 28.4 (2018): 316-331.

Why does it happen?

LEA as a result of:

- Extremely high energy expenditure during training
- Achieving the weight "necessary" for sports
- •Diets and desires for slimness...
- Lack of knowledge (misinformation!)
- •Logistical/practical challenges? (inappropriate meals at school, rush...)





The state of prolonged and/or severe (problematic) LEA leads to a disease...





Relative energy deficiency in sports (REDs)

A syndrome of impaired physiological and/or psychological functioning experienced by female and male athletes that is caused by exposure to <u>problematic (prolonged and/or severe) low energy</u> <u>availability (LEA)</u>.

The detrimental outcomes include, but are not limited to:

- · decreases in energy metabolism,
- reproductive function,
- musculoskeletal health,
- immunity,
- glycogen synthesis and
- · cardiovascular and haematological health,

which can all individually and synergistically lead to impaired well-being, increased injury risk and decreased sports performance.



How does REDs look like?











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Conceptual model of REDs health consequences







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Mountjoy, Margo, et al. "2023 International Olympic Committee's (IOC) consensus statement on Relative Energy Deficiency in Sport (REDs)." *British Journal of Sports Medicine* 57.17 (2023): 1073-1097.



Conceptual model of REDs sports consequences









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Mountjoy, Margo, et al. "2023 International Olympic Committee's (IOC) consensus statement on Relative Energy Deficiency in Sport (REDs)." *British Journal of Sports Medicine* 57.17 (2023): 1073-1097.

Red flags for REDs

Mood swings (irritability, depression, nausea...)

Common and longterm illnesses Missed menstruation (primary/secondary amenorrhea)

Excessive fatigue

Stress fractures, frequent injuries

Weight loss or binge eating/eating disorders





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Sports nutrition recommendations

Daily dietary and energy intakes

Regular meals (three main + snack + before and during and after training)

Energy intake adjusted according to daily needs (age, gender, body composition, amount and type of training, other daily activities)

Planning is key, especially during travel and during periods of heavier loads (important competitions, preparations)

Sufficient energy intakes, and especially strategic macronutrient intakes, around physical activity

MACRONUTRIENTS







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Carbohydrates (CH)

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The most important thing is to get enough CH before, during and after exercise!



ARUSA sports

Thomas et al, Position of the Academy of Nutrition and Dietetics, Dietitians of Canada, and the American College of Sports Medicine: Nutrition and Athletic Performance, 2017

Recommended daily carbohydrate intake

Type of workout	Recommended CH intake (per day)
Light to moderate training (> 1 h/d at low intensity)	3-5 g/kg/d
Moderate training (1-3 h/d at medium to high intensity)	5-7 g/kg/d
Heavy training or competition period (≥ 4 h/d at medium to high intensity)	8-12 g/kg/d (or more)







Not all carbs are the same – which is better when?







Side effects of low CH intake

- Increased risk of injury
- Increased risk of infection
- Poorer absorption of iron from food (chronic iron deficiency!)
- Increased feeling of overexertion during exercise
- Disrupted glycogen utilization pathways

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"A Bad Situation Made Worse: Low Carbohydrate Intake Amplifies Low Energy Availability Hormonal Disturbances"





Protein intake recommendations



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AFTER EXERCISE

- 0.3-0.4 g/kg or 20-25 g
- Combined with CH!!



To build and maintain muscle mass we need combination of PRO and CH!

Rawson et al. In: Maughan R, eds. Sports Nutrition, 2014

Different sources of protein



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PLANT BASED PROTEIN

ANIMAL BASED PROTEIN



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"Ye bro I only have one bottle of protein shake a day"

Do we really need all that protein???

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Recommendations for fat intake



1-2 g/kg/d
Athletes should consume a diet in which the proportion of fat contributes 15-20% of the daily energy intake (IOC)
Quality fats!









Source of energy

Vitamin absorption vitamins A, D, E & K

osorption - S

Structural component of cells & tissues Heart & brain health essential fatty acids



Promote fullness



Maintain cholesterol



Add flavour & mouth feel to food







Co-funded by the European Union Rawson et al. In: Maughan R, eds. Sports Nutrition, 2014

Summary of the different kinds of fat



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Importance of omega-3 intake – do we get enough?

Ideal ratio

Actual ratio

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Hydration



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During the day (**at least 2 L**): water, tea, less sugary drinks (diluted juices, etc.)

+ Fluid replacement during/after exercise: The need for fluids depends on the **amount of fluid lost during exercise (intensity, duration, humidity and temp of the environment, training of the athlete, etc.).**

With sweating we lose an average of 1-1.5 l of fluid with electrolytes (mainly Na and K) per hour of training.

<u>General recommendation:</u> <u>500-750 ml isotonic sports drink/hour of exercise</u> + the rest of the loss after the workout





What is the difference??

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Signs To Know You're Dehydrated



Prevent dehydration!!











It could have been harder...



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But also prevent overhydration...

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- Exercise associated hyponatremia or "water intoxication"
- Incidence ranging from 7 to 15%, mostly asymptomatic



WORLD & NATION

Runner's Death Blamed on Too Much Fluid

The death of a 28-year-old runner in this year's Boston Marathon was caused by a critical sodium imbalance brought on in part by drinking too much fluid, according to the state medical examiner.

Cynthia Lucero died of hyponatremic encephalopathy, which happens when the brain becomes swollen because of an imbalance of sodium, the medical examine said.

Runner's Death Blamed on Too Much

Fluid - Los Angeles Times

Exercise associated hyponatremia risk factors

Klingert, M et. al. Exercise-Associated Hyponatremia in Marathon Runners. *J. Clin. Med.* **2022**, *11*, 6775. https://doi.org/10.3390/jcm11226775



Synthesis of recommendations and practical advice







Adjust your nutritional strategy according to training!



The Athlete's Plates are a collaboration between the United States Olympic Committee Sport Dietitians and the University of Colorado (UCCS) Sport Nutrition Graduate Program. For educational use only. Print and use front and back as 1 handout.





Meal about an hour before training





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Intakes during exercise

- Basic recommendation: 30-60 g of OH per hour of exercise (for exercise longer than 1 hour)
- Adjust according to individual needs (low/high intensity, several hours of physical activity,..)
- In the form of sports drinks, energy gels and bars
- Increase intakes gradually (socalled "gastrointestinal training")

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The gut is extremely adaptable

Jeukendrup Training the gut for athletes Sports Medicine 2017

Recommendations chart



Carbohydrate intake during exercise



www.mysportscience.com

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Sports drink, bars or gels? It does not really matter...













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Recovery meal containing CH and protein (within an hour after exercise) + rehydration of at least 150% of the fluid lost!





What about that after-run beer?



Alcohol and recovery

Reduced muscle glycogen synthesis Mainly because guidelines for rapid glycogen synthesis are not followed

Reduces cognitive function day after which can decrease performance and increase risk of injury

Sleep quality may interfere with sleep quality



Reduces protein synthesis Impaired muscle repair and

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adaptation

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Reduces upper body power as well as peak power





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Alcohol

NUTRITION FOR COMPETITIONS

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The day before the competition

Strategy for competitions shorter than 60-90 minutes

In healthy muscle: optimization of glycogen stores in about 24 hours

Recommendations:

- Rest/Easy Activation
- CH intakes: 7-10 g/kg/day

Supercompensation of glycogen stores (or "carbo-loading") has no additional benefits for shorter competitions







Carbo-loading for longer events?

Glycogen supercompensation



www.mysportscience.com

MODERATE

protocol

supercompensation

Bieukendrup

CLASSICAL supercompensation protocol



From: Jeukendrup and Gleeson Sport Nutrition Human Kinetics Champaign IL, 2010



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Nutritional strategy 1-4 hours before the competition

Characteristics of the pre-exercise meal:

- Foods and drink rich in simple and easily digestible sources of CH
- Avoid foods rich in fat and fiber
- Low/moderate amount of protein

4 hours before the competition \rightarrow larger meal

For early competitions and GIT problems \rightarrow smaller meal + sufficient CH intake during the competition

Breakfast before competition

Size meal depends on time to digest





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Nutritional strategy in the hour before the competition

Recommendation: **75 g of simple CH in the hour before the competition**

Hypoglycemia (fatigue, increased HR, sweating, tremors) may occur in a <u>small proportion</u> of athletes – practical tips:

- Preliminary testing of the CH ingestion timeframe
- OH sources with a lower glycemic index (most fruits, skimmed dairy products, whole grains, lentils, etc.)
- Practice sufficient pre-race activation

Nutritional strategy is important!!!

What can nutritionally go wrong in a marathon?



Nutritional considerations for a marathon runner:

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dehydration increases the risk



Sports supplements

- Do we need them?
- Why and which?
- Are there possible dangers?

















Supplements and associated risks





Think before you take

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According to WADA's principle of strict liability, every athlete is responsible for the presence of a prohibited substance or its markers/metabolites in his/her biological samples, irrespective of whether or not the Anti- Doping Rule Violation was committed unintentionally or deliberately.

Always perform a careful risk benefit analysis and do everything to minimize risks





Categorizations of food supplements and indications

1. Specialized sports nutrition

2. Medical Dietary Supplements

3. Supplements for direct improvement of sports performance

https://www.ais.gov.au/nutrition/supplements/group_a

Specialized sports nutrition

WHEN?

Inability to cover nutritional and energy needs with 'normal' foods Sport drinks, energy bars and gels, protein shakes, liquid meals...





Medical Supplements

WHEN?

Micronutrient deficiencies or a high risk of deficiency Iron (deficiency), vitamin D (winter), vitamin B12 and calcium (vegetarians, vegans), zinc (for colds), multivitamins (travel, poor diet)







Supplements for direct improvement of sports performance

WHEN?

In serious athletes with previously successful optimization of the basic nutritional strategy → Caffeine, creatine monohydrate, nitrate, beta-alanine, sodium bicarbonate, glycerol



Where to find valid recommendations regarding sport supplements?

Guiding principles for AIS Sports Supplements Framework







Is there evidence that it "works"?

<u>Supplements | Australian</u> <u>Institute of Sport</u>



Australian Government



Australian Sports Commission

Supplements

Benefits and risks of using supplements and sports foods

Overview

Group A

Group B

Group C

C Group D

Athlete Resources

When it comes to nutrition and supplements keep in mind...

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The 3 most common mistakes by marathon runners





What did we learn?

- Adjust your nutritional strategy based on you daily needs
- Avoid problematic low energy availability
- Sufficient carbohydrate intake before, during and after exercise
- Avoid fats and fiber before exercise and competition
- Sufficient hydration, but do not overhydrate during running
- Be critical of supplements food first principle
- Practice your race nutritional strategy!!





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