NUTRITION FOR

FEMALE ATHLETES

This resource was created by Faye Townsend, Registered Sports Nutritionist (AfN & SENr)

FEMALE SPECIFIC CONSIDERATIONS

MENTAL HEALTH/SPORT ENVIRONMENT
- Symptoms/disorders
- Perfectionism
- Sexual harassment/abuse
- Caregiving duties

TRAINING
- Weekly training hours
- Rest days
- Recovery
- Exercise dependence/addiction

MUSCULOSKELETAL HEALTH
- Bone stress injuries
- Bone mineral density
- Skeletal muscle function
- Breast health

RELATIVE ENERGY DEFICIENCY IN SPORT (REDs)
- Health consequences (e.g., sleep disturbances, impaired energy, reduced immunity, etc.)
- Performance consequences (e.g., decreased endurance, training response, motivation, etc.)

MENSTRUATION
- Length, frequency, quality, symptoms
- Age of menarche
- Premenstrual syndrome
- Amenorrhea/Oligomenorrhea
- Menopause
- Hematological status (e.g. iron)

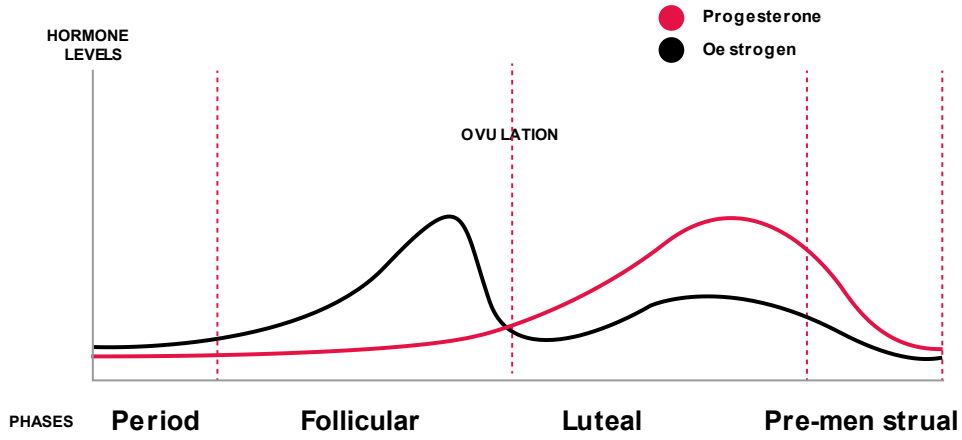
CONTRACEPTION
- Type
- Duration of use
- Reason for use (e.g. contraception, control of symptoms, etc.)

GYNECOLOGICAL/PELVIC HEALTH
- Pelvic floor dysfunction (e.g. incontinence)
- Gastrointestinal function
- Sexual function
- Pregnancy/postpartum
- Lactation

NUTRITION/EATING BEHAVIOURS
- Disordered eating patterns
- Eating disorder history
- Nutritional intake
- Dietary restraint

COMPLEXITY AND VARIATION IN WOMEN

Historically, women were often considered “more difficult” to study due to their higher level of hormonal intricacy and often excluded from research. Only 6% of sports science studies (2014–2020) focused exclusively on females.



The graph above shows hormonal fluctuations throughout a "normal" 28-day menstrual cycle.

How women differ from men:

- Men: Stable sex hormone levels post-puberty.
- Women: Cyclical ovarian hormone fluctuations (menstrual cycle) post-puberty in eumenorrheic individuals.

Cowley ES *et al.* 2021.

ADDING FURTHER COMPLEXITY

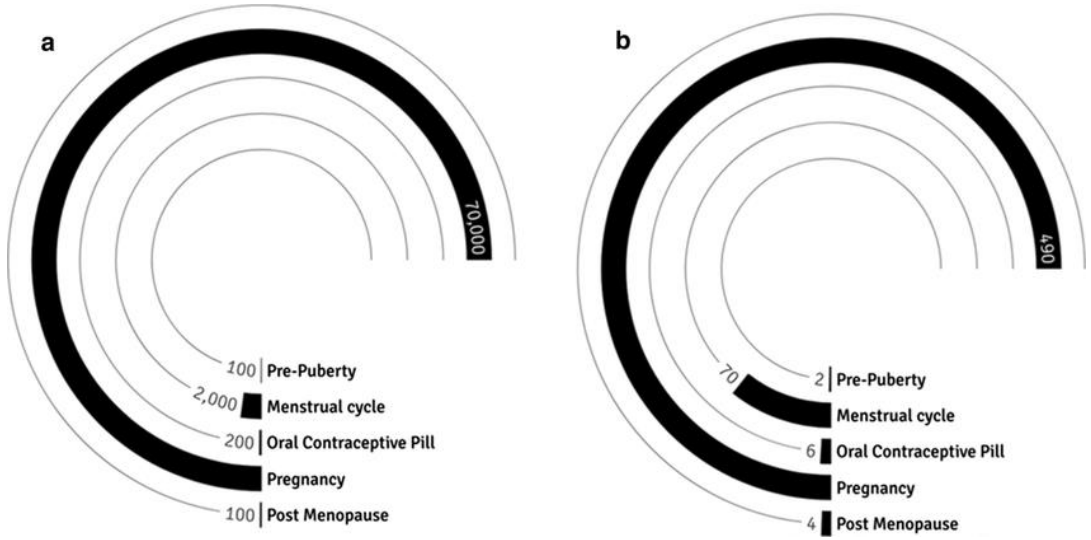
Hormonal variation across a woman's lifetime

More than just the menstrual cycle:

- Beyond monthly fluctuations, women experience dynamic hormonal shifts throughout their lives.

Lifespan hormonal changes:

- Hormonal contraceptives: Synthetic hormones alter natural cycles.
- Pregnancy: Extremely high oestrogen and progesterone.
- Menopause: Rapid ovarian hormone decline.



Oestrogen and progesterone profiles across the lifespan from childhood to senescence. A) Oestrogen b) Progesterone. Elliott-Sale et al. 2021

Elliott-Sale KJ *et al.* 2021

Sims ST *et al*. 2018, Elliott-Sale KJ *et al*. 2021

MECHANISM UNDERLYING MENSTRUAL CYCLE EFFECTS

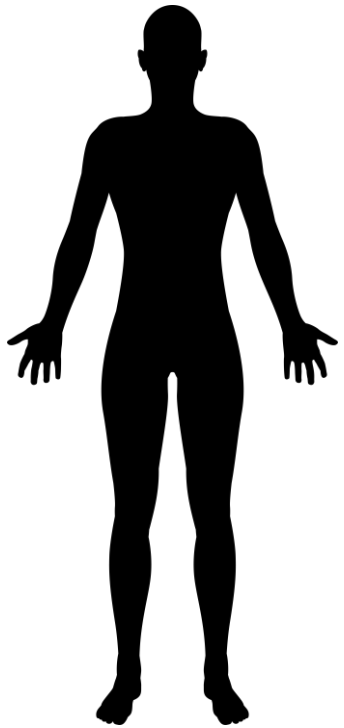
On exercise performance

OESTROGEN

MUSCLES & BONES
Protection against muscle damage
Muscle repair and regeneration
Protection for bone health.

ENERGY SYSTEMS
Blood sugars are more stable, and the body becomes more efficient at using fat for fuel, and spares glycogen (stored carbs).

BRAIN & NERVES
May increase confidence and focus.
May improve muscle activation, helping you feel more in control of movements.



PROGESTERONE

Acts as a counterbalance to oestrogen, potentially reducing its performance benefits.

THERMO-REGULATION
Raises body temperature.

NERVOUS SYSTEM
Calms your brain, making your body slower and less reactive, which can affect muscle control and reaction time.

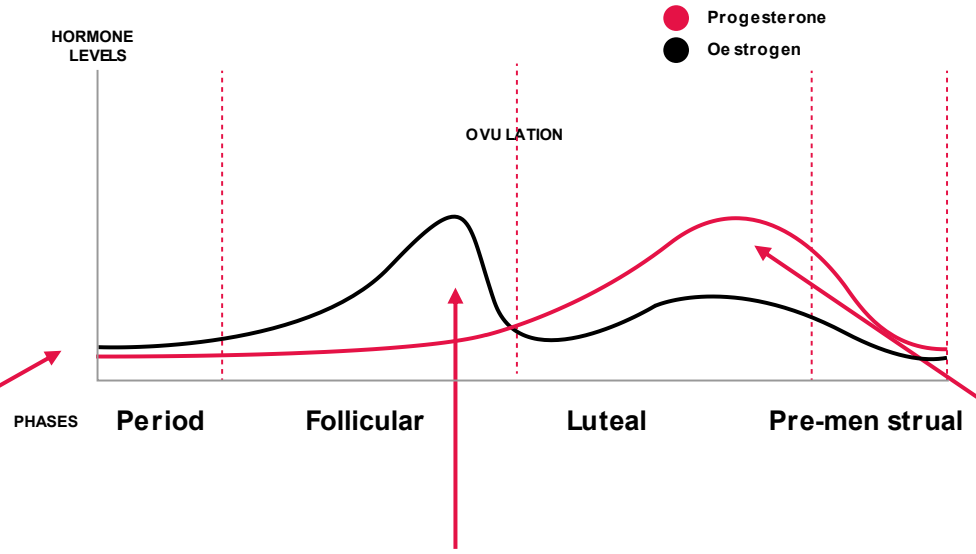
ENERGY SYSTEMS
Counteracts oestrogen's effects, promoting insulin resistance and greater reliance on carbohydrates.

Bernstein C, Behringer M. 2023

WHAT YOU MIGHT NOTICE

Menstrual cycle and performance

Theoretical Implications for Performance



No two cycles are the same. While some experience no noticeable changes, many report varying symptoms and shifts in performance across phases.

Low Hormone Phase (menstruation/period)

Menstrual-related symptoms (e.g., cramps, fatigue) may influence perceived performance

High-Oestrogen Phases (Late Follicular/Ovulation)

Elevated oestrogen levels may support strength and recovery, and reduce perceived exertion

High-Progesterone Phases (Mid-to-Late Luteal):

Increased progesterone may dampen oestrogen's benefits, potentially impacting coordination, recovery while increasing perceived exertion.

Taylor MY *et al.* 2024; Willett HN *et al.* 2021; Paludo AC *et al.* 2022; Kamemoto *et al.* 2022; McNulty *et al.* 2023

WHAT DOES THE RESEARCH SAY?

Does it impact performance? -Meta-analysis key findings

Natural Cycles
Key Findings:

- The biggest performance difference appears to be between the early (menstruation) and late follicular phases. However, the average effect is minimal with considerable overlap in performance across phases.
- On average, exercise performance might be reduced by a trivial amount in the early follicular phase of the Menstrual Cycle compared with all other phases.

When does it become more relevant?
Trivial effects might be greater relevance to elite athletes, where the difference between winning and losing is marginal.

OCP Users
Key findings

• Oral Contraceptive Pill (OCP) users might lead to slightly inferior exercise performance compared to natural menstrual cycles.
• Any group-level effect is likely trivial, so no general guidance is warranted for OCP use vs. non-use
• Exercise performance remains relatively consistent across the OCP cycle.

• No need for different guidance on OCP-taking days versus non-OCP-taking days.

McNulty KL *et al.* 2020; Elliott-Sale KJ *et al*. 2020.

BRIDGING THE GAP: LEARNING FROM RESEARCH AND INDIVIDUAL TRACKING

HOW TO TRACK:

- Duration of your menstrual period: Was it shorter or longer compared to the previous month?
- Daily variations in vaginal discharge: Was it clear/white, thick/thin, sticky/slippery?
- Workout performance: What activities did you do? Did you meet your workout goals? Did it feel harder or easier compared to previous sessions?
- Recovery: Did you experience any soreness, new injuries, or flare-ups of existing injuries?
- Hunger and thirst: What did you eat post-workout? Was it satisfying? Did you feel more thirsty than usual?
- Symptoms: Did you experience cramping, headaches, moodiness, forgetfulness, bloating, or breast tenderness?

Insufficient evidence to provide generalisable nutritional advice for female athletes to tailor their requirements to menstrual status or the menstrual cycle, primarily due to a lack of quality research to support any such recommendation (Holtzman & Ackerman, 2021).

Tracking your own cycle can help identify patterns in symptoms and performance, enabling personalised adjustments for optimal outcomes.

Collect this data for a minimum of 3 months. By analysing the data and referencing relevant research, we can provide personalised recommendations that align with each athlete's unique physiological responses.

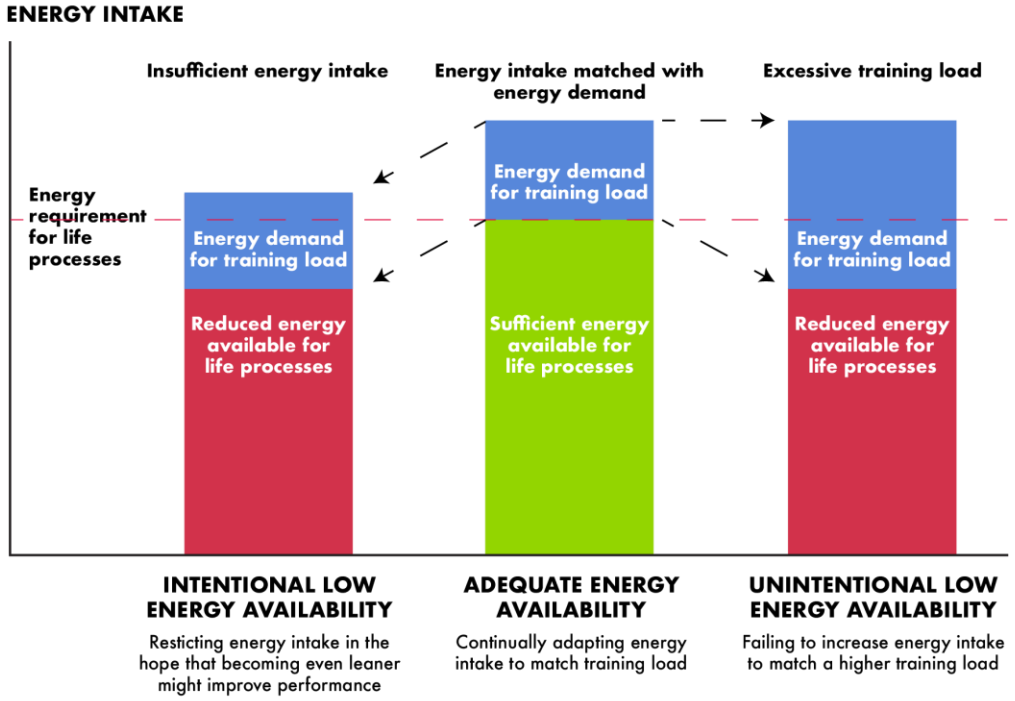
Holtzman B, Ackerman KE 2021

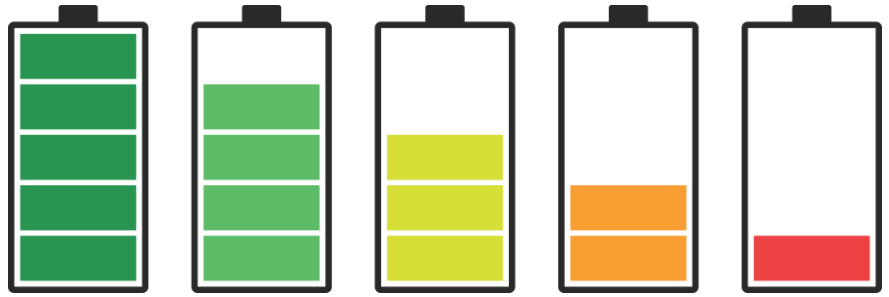
RELATIVE-ENERGY DEFICIENCY

RED-S

WHAT IS RED-S?

- When Low Energy Availability (LEA) persists, athletes may develop Relative Energy Deficiency in Sport (RED-S), syndrome that affects multiple bodily systems and impacts overall performance and long-term health.



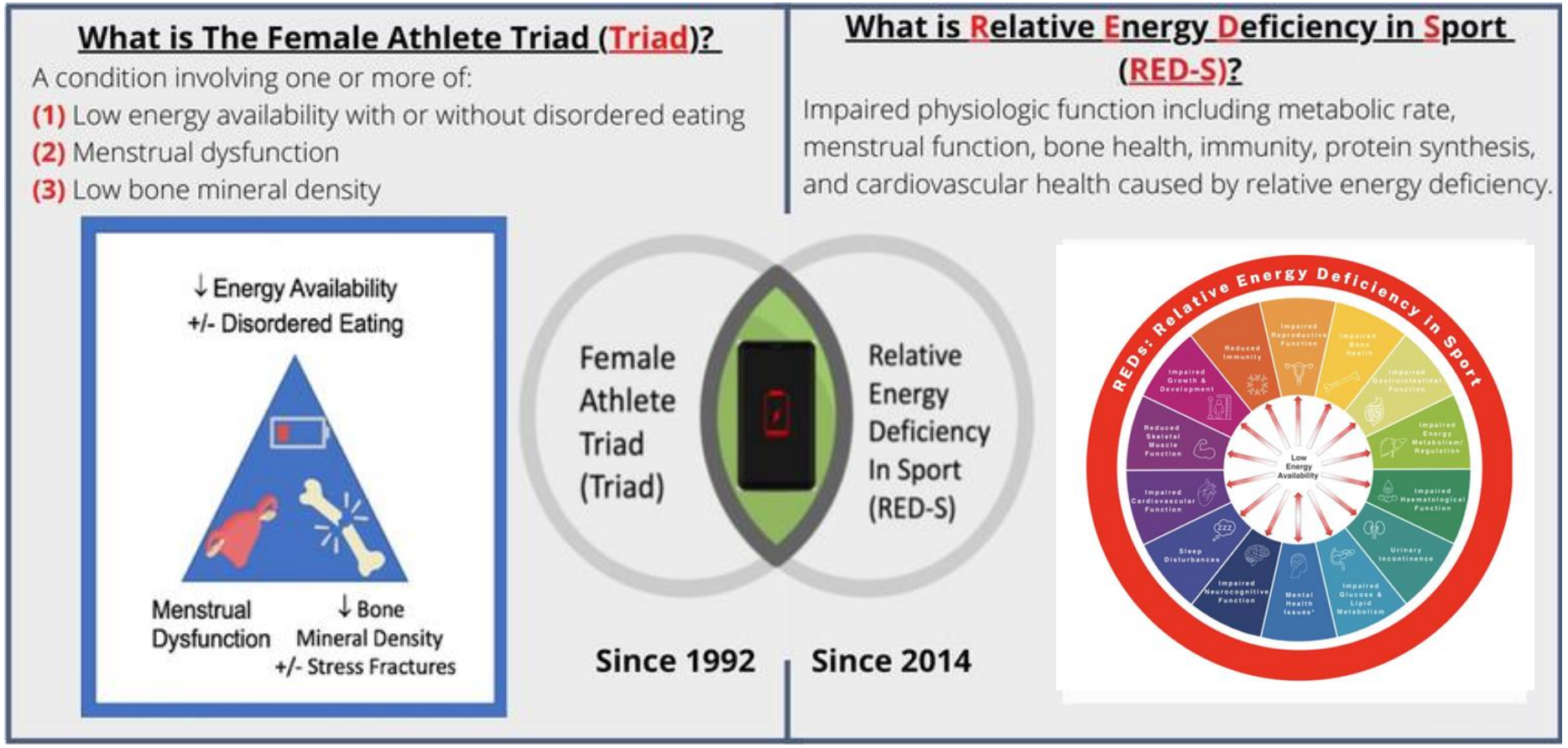


Energy Intake ≠ **Training demands and essential bodily functions** → **Low Energy Availability (LEA)**

Recreated with permission from Dr. Nicky Keay. See Keay N & Francis G. 2019

UNDERSTANDING RISK FACTORS OF RED-S

THE EVOLUTION OF RED-S FRAMEWORK

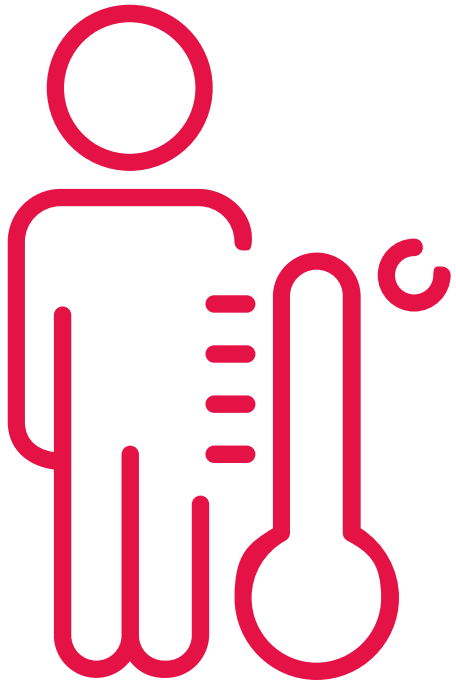


Triad and RED-S Comparison (Credit: Warwick *et al.* 2023, reproduced under the Creative Commons license CC by 4.0)

Mountjoy M *et al.* 2014; Mountjoy M *et al.* 2015; Mountjoy M *et al.* 2018; Mountjoy M *et al.* 2023.

FEMALE-SPECIFIC NUTRITION CONSIDERATIONS

THERMO-REGULATION



Why Hydration Matters

Dehydration exceeding 2-3% of body weight can significantly reduce physical performance.

How Menstrual Phases Influence Hydration

For women, basal body temperature (BBT) rises by 0.3-0.5°C after ovulation and stays high during the luteal phase. These changes may affect thermoregulation and hydration needs.

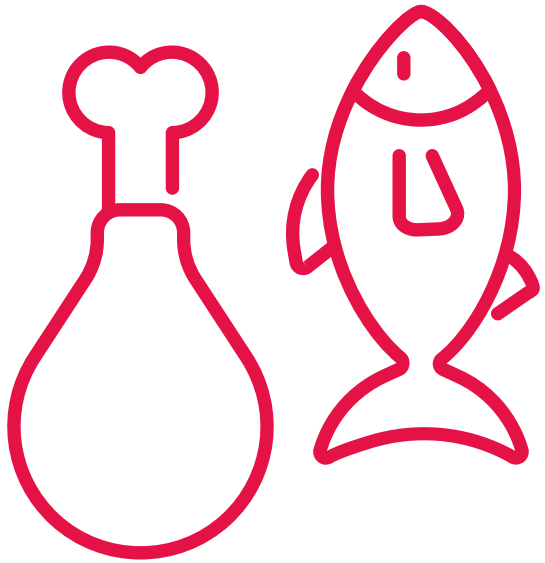
Exercising in the Heat

Research suggests that during the luteal phase, the body's sustained BBT increase may heighten susceptibility to heat-related issues (Giersch, 2020). This could make exercise feel harder, causing earlier fatigue or slower pacing, especially during endurance activities.

What This Means for Training:

- Track Hydration Needs: Monitor sweat rates throughout your cycle and adjust your fluid intake accordingly.
- Incorporate Cooling Strategies: Use pre- and post-exercise cooling techniques, like cold water immersion or ice packs, to manage heat stress effectively.
- Listen to Your Body: Watch for signs of heat illness (dizziness, nausea, fatigue), and take immediate action if they arise.

PROTEIN



How Much Protein is Needed

Aim for 1.4–2.2 g of protein per kg of body weight each day. Spread it out across meals and snacks, including after exercise, to support muscle repair and recovery.

Luteal Phase Consideration

During the luteal phase, there may be an increase in protein breakdown due to hormonal changes. This means protein needs could be slightly higher during this phase.

When and What to Eat

To maximise muscle repair and growth, aim for ~0.3g protein per kg of body weight of high-quality protein in each meal or snack (or every 3 hours). This should include around 3 g of leucine and 6–10 g of essential amino acids to support muscle protein synthesis.

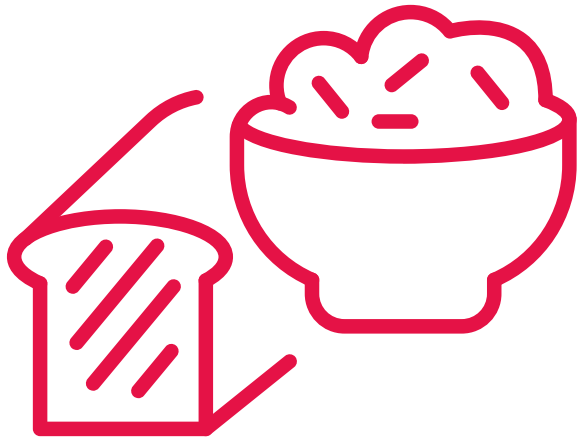
What This Means for Training

Consistent protein intake throughout the day helps with muscle repair, recovery, and growth. During the luteal phase, protein needs may be slightly higher, so planning meals and snacks with protein in mind can support performance and recovery. Prioritising a protein-rich meal or snack after training is key to maximising muscle repair.

Sims ST *et al.* 2023

CARBOHYDRATES

How the Menstrual Cycle Can Affect Energy Use in Training



Fuel Use Changes

Late Follicular Phase: Higher Oestrogen levels may help your body use more fat for fuel and save glycogen (carbohydrates) for later use.
Luteal Phase: Higher progesterone levels may make it harder for your body to use fat for energy.

Why Pre-Workout Carbohydrates Matter

Pre-exercise carbohydrates can help maintain energy levels, particularly during phases where reliance on glycogen may be higher (e.g., luteal phase).

What This Means for Training

To maintain steady energy levels, it's a good idea to include carbohydrates before and during exercise, no matter what phase of the cycle you're in. This approach supports consistent energy for training, regardless of hormonal changes.

Key Insights: Evidence on carbohydrate needs across phases is inconclusive, and the impact on performance varies

Bernstein & Behringer 2021; 2022; Willett *et al.* 2021

MICRONUTRIENT CONSIDERATIONS

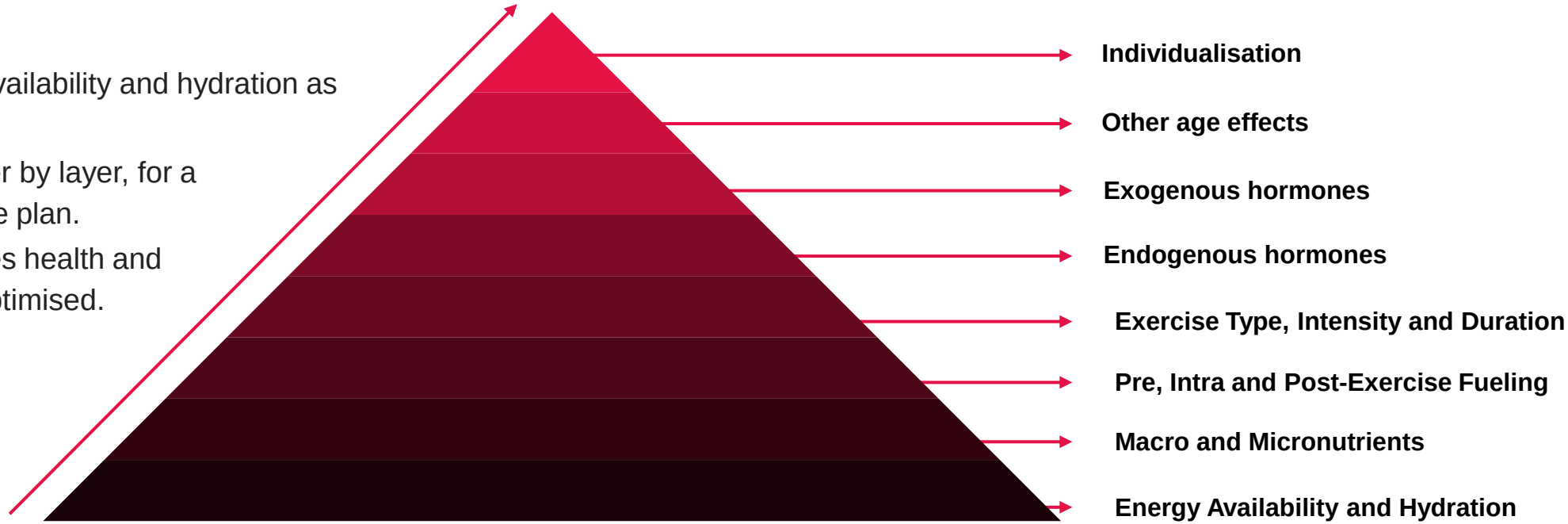
Micronutrient	Role	Recommended Intake (Daily)	Health Impacts of Deficiency	Practical Implications	Why Females Are at Higher Risk
 Iron	Oxygen transport, energy metabolism	UK RNI 14.8 mg/day (women aged 19-50). Although, female athletes may need more to meet higher demand	Fatigue, reduced endurance, compromised performance	Routine screening is recommended for high-risk individuals, such as vegan athletes and females with heavy menstrual cycles (e.g., every six months). For improved absorption, pair iron intake with vitamin C.	Higher susceptibility due to menstrual blood loss and increased iron needs from endurance training
 Calcium	Bone health, muscle contraction	1,000–1,300 mg. At risk athletes - 1,500 mg	Stress fractures, lower bone density	Encourage dietary calcium. Spread out across the day (i.e in 500mg sittings)	Increased risk with menstrual dysfunction (e.g., amenorrhea) affecting bone mineral density
 Vitamin D	Supports calcium absorption, immune function	1000–2000 IU vitamin D3, depending on time of year and regular sun exposure.	Reduced bone density, increased fracture risk	Monitor particularly in low sunlight seasons; consider supplementation	Indoor training and limited sun exposure, particularly during winter months, lead to higher deficiency rates

WHAT SHOULD BE PRIORITISED?

FOR FEMALE ATHLETES

HIERARCHY OF NUTRITIONAL NEEDS

- A holistic approach ensures foundational needs are prioritised.
- Start with energy availability and hydration as the base.
- Build upwards, layer by layer, for a tailored, sustainable plan.
- Progression ensures health and performance are optimised.



KEY TAKEAWAYS

- High-quality evidence is limited: Research on female athletes, especially the impact of menstrual cycle phases, is still developing.
- Every woman is different: Hormonal fluctuations affect everyone differently. What works for one athlete may not work for another.
- Track your cycle: Monitor symptoms, performance and recovery to identify personal patterns and inform training adjustments.
- Prioritise energy, nutrition and hydration: Maintain consistent energy availability, hydration, and sufficient protein intake to support recovery and performance.
- Use research as a guide, not a rule: While evidence is limited, the research reviewed today highlights possible performance changes across cycle phases.

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Hierarchy of Nutritional Needs

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THANK YOU

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