QRL FEMALE ATHLETE PHYSICAL FRAMEWORK

TRAINING, RECOVERY AND PERFORMANCE FOR
FEMALE RUGBY LEAGUE PROGRAMS

A practical coaching guide grounded in current sport science,
developed by Dr Leesa Grier, James Cook University, in partnership
with the *Queensland Rugby League*

QRL FEMALE ATHLETE PHYSICAL FRAMEWORK

CONTENTS



1. Overview and Guiding Principle **04**
- Anatomical Sex Differences 04
- Biomechanical Differences 05

2. Neuromuscular Control **10**

3. Strength Training **12**

4. Conditioning **16**

5. Speed, Change of Direction and Contact Preparation **18**

6. Menstrual Cycle Considerations **22**

7. Flexibility and Mobility **26**

8. Recovery **28**

9. Optimal Adaptation to Training and Sleep **30**

10. Coach Manual **34**
- Development Pathway Framework 35
- Minimum Environment for female athlete training 36
- Recommendations 38
- Preseason week and In Competition week 39
- Neuromuscular Control training 43
- Strength session 44
- Conditioning session 44
- Acceleration deceleration and cutting session 46
- Reading the athlete 48
- Scenario based responses for coaches 49

11. Coaching Principles **51**

References 52

OVERVIEW AND GUIDING PRINCIPLE

Sex specific neuromuscular control and biomechanics need to be considered within strength and conditioning practice to enhance immediate performance and the long-term musculoskeletal health of the female athlete (Dabbs et al., 2026a).

The core message of this guide is straightforward: the principles of training do not change for female athletes, but the way those principles are applied must. Female athletes have unique anatomical and physiological considerations that can influence performance, recovery, health and injury risk. That is not a limitation, it is information that allows you to coach more effectively.

For example, female athletes are at up to six times greater risk of ACLL (anterior cruciate ligament, the key stabilising ligament in the knee) (Hewett et al., 2006), injury compared to male athletes. This is not simply bad luck. It is driven by a combination of anatomical, hormonal, and neuromuscular factors that good coaching can directly address.

ANATOMICAL AND PHYSIOLOGICAL SEX DIFFERENCES

From adolescence onward, female bodies undergo biological changes that affect movement, strength, and performance:

Pelvis widens significantly at puberty, and it has a cascade of effects down the leg, including:

1. Greater Q-angle: the Q-angle is the angle between your hip and kneecap (ASIS to the centre of the patella, to the tibial tubercle). Because the female pelvis is wider, this angle is on average 17 degrees in females versus 14 degrees in males (Gant et al., 2024). A larger Q-angle means more lateral (sideways) force is placed on the kneecap and knee joint, increasing injury risk during cutting, landing, and jumping.
2. Lower tendon stiffness and greater joint laxity (Moriceau et al., 2022): female tendons (which connect muscle to bone) are generally less stiff than male tendons, and female ligaments (which connect bone to bone) allow more joint movement. This gives greater flexibility, but also means joints need stronger muscular support to stay stable.
3. Reduced rotational stability: female hip anatomy and the Q-angle together mean the knee is more likely to rotate inward (collapse) under load (Moriceau et al., 2022). Training to resist this is a core focus of this program.
4. Different injury mechanisms and prevalence: ACL tears, patellofemoral (kneecap) pain, and ankle injuries occur more frequently and by different movement patterns in female athletes (Zech et al., 2022).
5. Higher proportion of Type I (slow twitch) muscle fibres: Females tend to have proportionally more Type I (endurance-oriented, fatigue-resistant) muscle fibres compared to males, who have proportionally more Type II (powerful but faster-to-fatigue) fibres (Haizlip et al., 2015; Nuzzo, 2024). This affects how female athletes respond to conditioning and fatigue. This does not limit their capacity to develop power and speed. It means they recover between high-intensity efforts more efficiently than their male counterparts, which is an advantage in repeat-effort sport.
6. Hormonal differences: oestrogen, progesterone, and testosterone are present in different amounts and ratios in female athletes. These hormones affect muscle tissue, tendon properties, recovery, and energy use across the menstrual cycle (Holdsworth et al., 2026; Dabbs et al., 2026b).
7. Varying lactate thresholds, oxygen utilisation, and fatigue responses influenced by hormonal fluctuations across the menstrual cycle (covered in Section 6). Oestrogen also has antioxidant and anti-inflammatory properties that may support greater skeletal muscle recovery following training (Dabbs et al., 2026b).

DIFFERENT CUTTING STRATEGIES

Beyond anatomy, female athletes move differently from male athletes in ways that matter for performance:

1. Dynamic knee valgus may be observed during landing, deceleration and change-of-direction activities. This movement pattern is influenced by a combination of factors including lower-limb alignment, strength, neuromuscular control, maturation and training history. When excessive, dynamic knee valgus may increase knee loading and is therefore an important consideration in injury prevention and movement development programs (Ramachandran et al., 2024).
2. Reduced hip and trunk contribution to deceleration: female athletes more commonly absorb ground forces through the knee rather than the hip (Sugimoto et al., 2016). Training the hip and glutes to share the load protects the knee and improves performance.
3. On average, female athletes show less peak knee flexion (less bend) than male athletes when cutting, a position commonly seen in non-contact ACL injuries (Donelon et al., 2024).
4. Optimal movement patterns are trainable. The neuromuscular training in this program directly targets them.



LANDING MECHANICS

EVERY LANDING TEACHES THE NERVOUS SYSTEM

Good movement habits, practiced repeatedly, become automatic and protective.
Poor movement habits, also practiced repeatedly, become hardwired risks.

GOOD LANDING

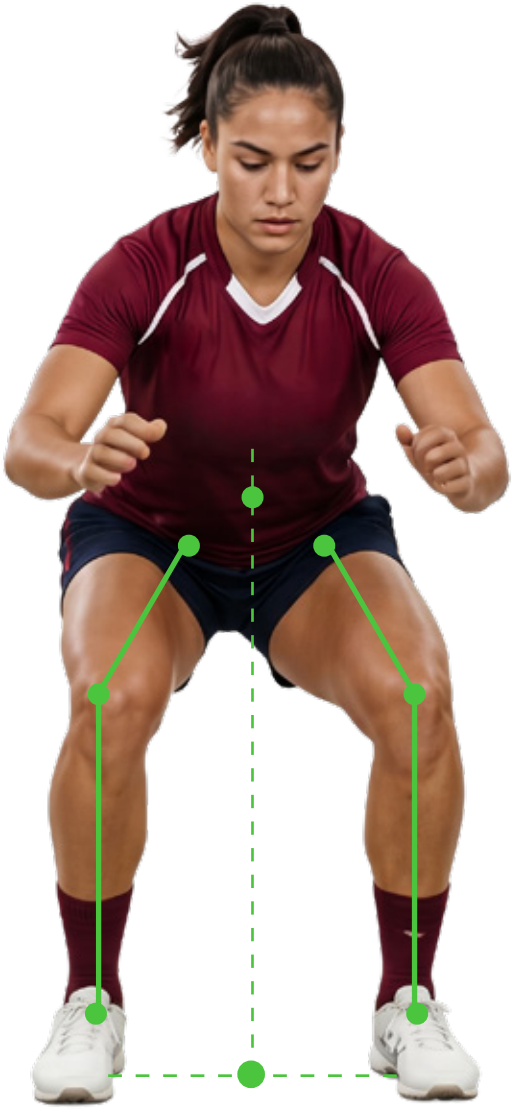
STRONG · CONTROLLED · PROTECTIVE

HIP LOADED
Hips back and engaged to absorb and control force.

KNEE OVER SECOND TOE
Knee tracks in line with foot to reduce stress on the ACL.

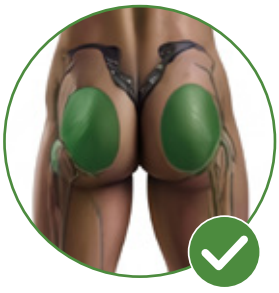
STABLE TRUNK
Neutral spine and upright posture for better control.

SOFT LANDING
Quiet feet, bent knees and controlled absorption.





OPTIMAL KNEE ALIGNMENT
Lower ACL load and lower injury risk.



GREATER HIP CONTRIBUTION
Glutes and hips absorb force and protect the knee.

BETTER MOVEMENT → BETTER PERFORMANCE → LOWER INJURY RISK

KEY COACHING POINTS

LOOK: Knee over toe, hips back, chest up.

THINK: Absorb force with hips and glutes.

CUE: "Bend, load, land soft and stay aligned."

REPEAT: Quality movement becomes automatic.

PROTECT: Great landings build durable athletes.

POOR LANDING

UNSTABLE · INEFFICIENT · INJURY RISK



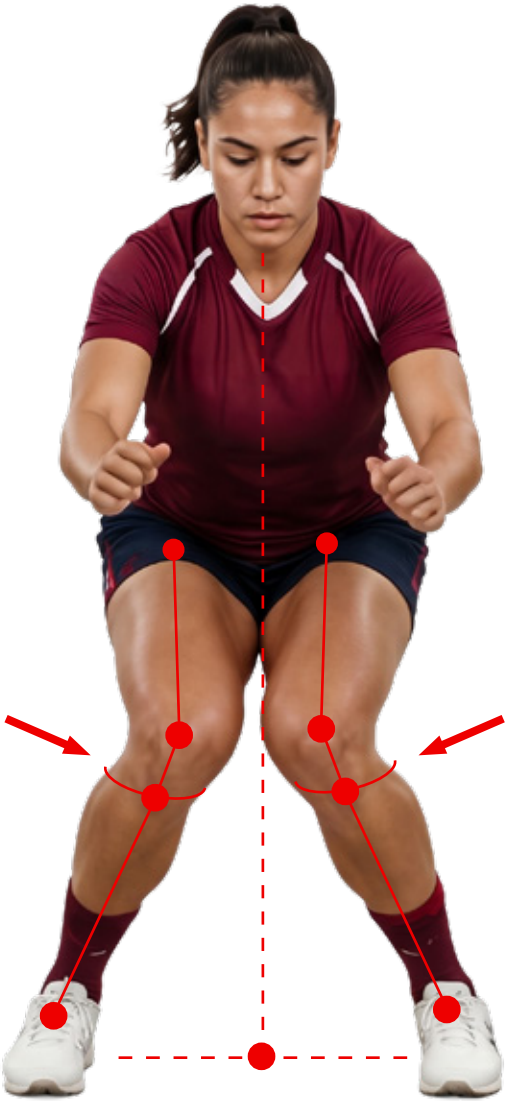
INCREASED ACL LOAD

Higher risk of ACL injury and other knee injuries.



GREATER KNEE DOMINANT LOAD

More stress through the knee joint.



UPRIGHT POSTURE

Less hip engagement leads to greater knee loading.

KNEE VALGUS (COLLAPSE)

Knee falls inward increasing stress on the ACL.

REDUCED HIP CONTRIBUTION

Quads and knees absorb more force than the hips.

HARD LANDING

Louder landings increase shock and injury risk.

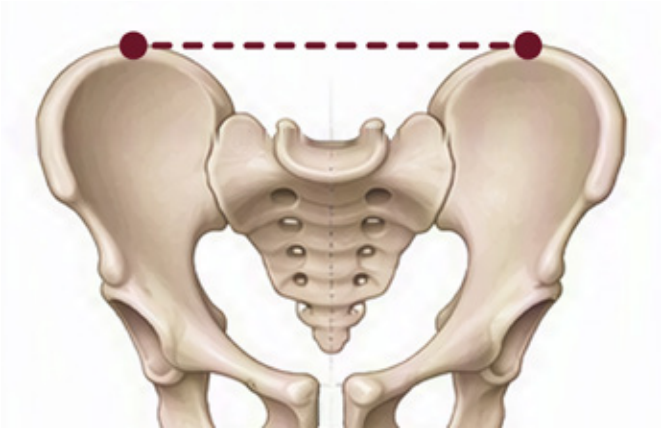
POOR MOVEMENT → POOR PERFORMANCE → HIGHER INJURY RISK

FEMALE ANATOMY & ACL RISK

UNDERSTANDING THE DIFFERENCES. COACHING THE SOLUTIONS.

1 WIDER PELVIS

From puberty, females develop a wider pelvis to support reproductive function.

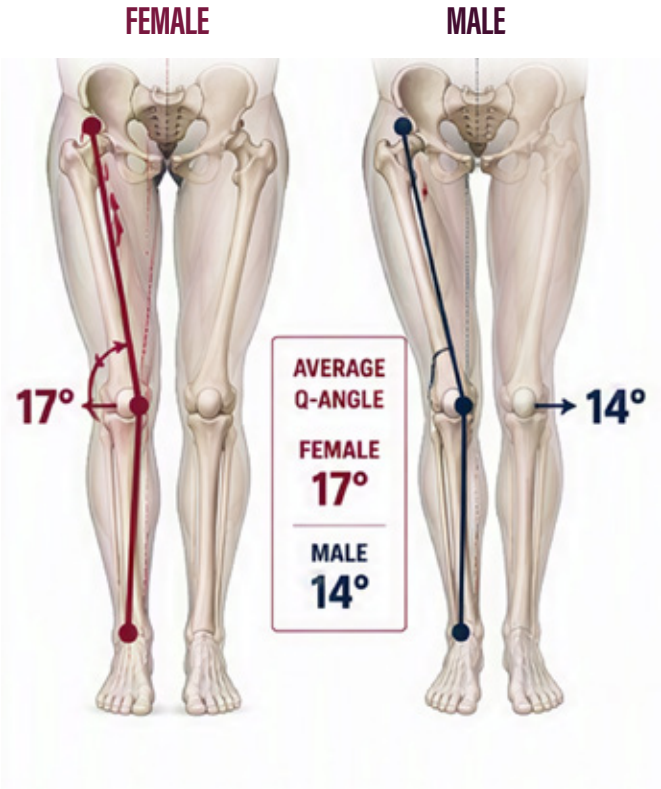


FEMALE	VS	MALE
WIDER PELVIS		NARROWER PELVIS

A wider pelvis influences the alignment of the femur and knee, increasing the Q-angle and the knee's tendency to move inward under load.

2 GREATER Q-ANGLE

The Q-angle is the anglebetween your hip and kneecap (ASIS to the centre of the patella, to the tibial tubercle). Females have a larger Q-angle on average.



KEY IMPLICATIONS

HIGHER ACL RISK
Female athletes are up to six times greater more likely to rupture their ACL than males. (Zech et al., 2022)

MOVEMENT MATTERS
Poor landing, cutting and deceleration technique increases valgus and ACL load.

HIP & GLUTE STRENGTH
Stronger hips improve knee alignment and reduce harmful forces.

ANATOMY SETS THE STAGE. MOVEMENT WRITES THE STORY.

FEMALE BODIES ARE NOT SMALLER MALE BODIES. THEY ARE DIFFERENT. COACHING MUST REFLECT THAT.

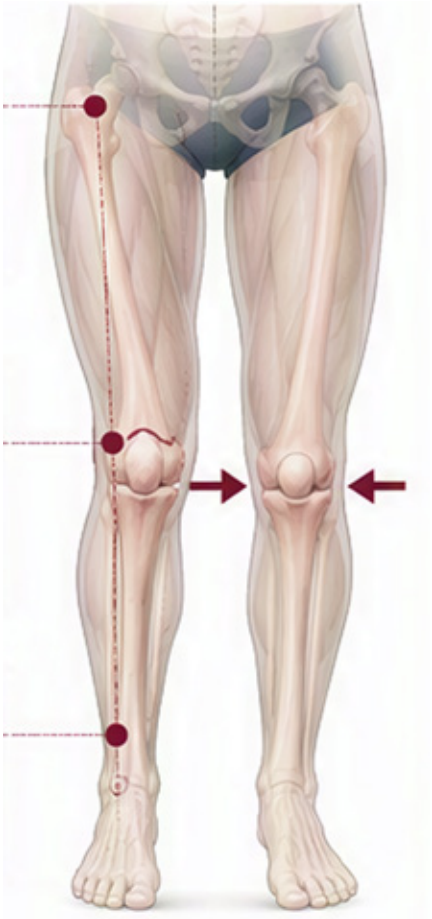
3 KNEE ALIGNMENT

A greater Q-angle increases lateral (sideways) forces on the knee and contributes to a higher likelihood of knee valgus (inward collapse) during dynamic movements.

HIP
Wider pelvis changes the line of force

KNEE
Greater tendency for inward movement (valgus)

ANKLE / FOOT
Compensatory movement patterns



4 ACL RISK PATHWAY

These anatomical and biomechanical factors increase stress on the ACL during high demand movements.

WIDER PELVIS
Changes lower limb alignment

↓

GREATER Q-ANGLE
Increases lateral force at the knee

↓

KNEE VALGUS
More inward collapse under load

↓

INCREASED ACL LOAD
Higher risk of ACL injury

NEUROMUSCULAR CONTROL
The brain must learn and rehearse optimal movement patterns under load, at speed and when fatigued.

CONSISTENT TRAINING
Regular, quality NMC training is essential for performance and long-term durability.

COACH THE DIFFERENCE. PROTECT THE ATHLETE.

UNDERSTAND THE DIFFERENCE. COACH THE SOLUTION.

NEUROMUSCULAR CONTROL

Neuromuscular control is the ability to coordinate and control movement in response to the demands of sport. While strength provides the capacity to produce force, neuromuscular control determines how effectively that force is applied during activities such as running, landing, decelerating and changing direction. Together, they underpin efficient movement, performance and injury resilience in rugby league players.

The brain learns neuromuscular control (NMC) through repetition. Every time an athlete jumps, lands, sprints, decelerates, or changes direction, the brain is recording the movement and refining its strategy (Dabbs et al., 2026b).

This means:

- Good movement habits, practised repeatedly, become automatic and protective
- Poor movement habits, also practised repeatedly (including in play), become hardwired risks

The brain builds its movement strategies based on:

- The skeleton (shape, joint angles, limb lengths)
- The strength and endurance of the muscles available
- Its memory of past movements: jumping, landing, tackling, decelerating, squatting

For coaches: Just as muscles get stronger with training, the brain can be trained to control movement better under load, at speed, and under fatigue. This is why neuromuscular control training should be the focus additional to the warmup.

Duration: 15 minutes per session

Fifteen minutes is the minimum effective dose supported by the evidence (Myer et al., 2004; Sugimoto et al., 2016). This should be performed in addition to, not instead of, the warm-up. Where possible, neuromuscular control (NMC) training should be delivered as a standalone session before training. While concerns about time are common, the return on investment is clear: 15 minutes of targeted NMC training can significantly reduce the risk of a season-ending injury. Few training interventions offer a greater benefit for such a small time commitment. Coaches and performance staff should work together to ensure NMC training is prioritised and either completed before training or integrated throughout the session where appropriate.

Equipment: Bodyweight, resistance bands (light/medium/heavy), low box (15-35 cm), foam pad (Phase 3-4).

Sequence: Critical ground to standing to loaded single leg. Each layer activates the system the next relies on.

Complete all supine and ground-based exercises first, then progress to standing, then to loaded single-leg tasks. This follows the evidence-based principle of proximal-to-distal activation: establishing trunk and hip control before the distal chain is asked to stabilise under force (Myer et al., 2004). All movements are slow and deliberate, particularly in Phases 1 and 2.

Recommended Session is in Coaches Manual section of this booklet.

The NMC program is structured across four progressive phases spanning 20 weeks. Each phase builds on the neuromuscular adaptations of the previous one, increasing complexity, load, and velocity demand as athlete competency develops Nimphius and Kadlec (2026).

Phase	Weeks	Label	Primary Overload	Theme
Phase 1	1-5	Establish	Pattern and motor learning	Learn the movement and firing sequence at bodyweight
Phase 2	6-10	Load	Load and volume	Heavier bands, more reps and sets, tempo challenges
Phase 3	11-15	Integrate	Instability and complexity	Functional positions, single-leg demand, unstable surfaces
Phase 4	16-20	Express	Velocity and reactive demand	Sport speed, reactive cues, maximum voluntary contraction (move with full effort, as explosively as possible)

Table 1: NMC Program Phase Overview

For female rugby league athletes, the NMC program must address the following muscle groups as a minimum:

- **Gluteus medius and maximus:** Primary controllers of frontal plane knee stability and pelvic position during landing, cutting, and deceleration
- **Vastus medialis oblique:** Patellar tracking and terminal knee extension under load
- **Deep hip rotators:** Rotational stability of the hip in single-leg and contact positions
- **Tibialis anterior and fibularis:** Ankle stiffness and foot stability during ground contact
- **Deep cervical flexors and neck extensors:** Cervical spine control during collision and tackling scenarios
- **Transverse abdominis and multifidus:** Trunk stiffness under contact load, protecting the lumbar spine
- **Rotator cuff and scapular stabilisers:** Shoulder joint stability during ball carrying, tackling, and ground contact

In contact sport, the trunk and cervical spine demands are non-negotiable additions to the lower limb focus standard in most ACL-prevention program (Sugimoto et al., 2016; Nimphius and Kadlec, 2026).



STRENGTH TRAINING

STRENGTH TRAINING PRINCIPLES

Separate to Neuromuscular Control Program

1. Progressive overload, gradually increasing the challenge over time
2. Specificity, training the movements and muscles most relevant to the sport
3. Individualisation, adjusting for each athlete's current capacity
4. Consistency, regular training drives adaptation
5. Recovery, rest is the only time the body repairs and improves

BUILD THE FOUNDATION FIRST

Before adding heavy loads, female athletes should master their own bodyweight in key positions: Squat, hinge, and single-leg balance.

Progress to split-stance positions, which more closely replicate in-game demands.

Movement quality under any load is non-negotiable. A technically poor squat at 60 kg is more dangerous and less effective than a technically excellent squat at 20kg.

Muscles adapt quickly, but ligaments and tendons do not. They need time to develop the tensile strength to tolerate increasing stress. Progress the weight when the movement is clean, not before.

AT ENTRY TO THE TALENT DEVELOPMENT PATHWAY

Female rugby league athletes commonly exhibit lower movement competency compared to males (Grier et al., 2026). Opportunity, accessibility and a changing musculoskeletal system all contribute to these baseline levels (Grier et al., 2026). Differences in ability between train and untrained athletes will also be common on the gym floor (Suchomel et al., 2016). These findings support neuromuscular control training focus, and where possible, movement screening assessments carried out more frequently during this period (Grier et al., 2026).

LOAD APPROPRIATELY

In highly trained athletes, female athletes demonstrate gains in maximal strength, relative strength and muscle cross-sectional area comparable to those seen in male athletes under equivalent training conditions (Dabbs et al., 2026b). In developing athletes, sex differences in strength and muscle size are more apparent, and they reflect training history and opportunity as well as biology (Dabbs et al., 2026a; Dabbs et al., 2026b). We recommend ensuring foundational movement quality and a gradual build-up of load first. Once the foundation is established, progressive overload remains essential. Female athletes are frequently underloaded in coached settings, a pattern that reflects assumptions rather than evidence (Zouita et al., 2023; Dabbs et al., 2026b). Underloading is not caution. It is a missed training stimulus.





THE CORE MOVEMENTS

If the NMC program is being delivered consistently, the neuromuscular system is being prepared for the demands of the gym session. The hip abductors, deep rotators, and trunk stabilisers are already activated. The strength session builds on that foundation rather than starting from a cold system. The gym session is about six foundational patterns:

- Squat
- Hinge (deadlift)
- Push Upper limb
- Pull Upper limb
- Core stability (neck strength)
- Carry or power movement

Upper-body strength is notably lower in female athletes even when lean body mass is accounted for (Dabbs et al., 2026b) and this gap matters in contact sport where pushing, carrying, and tackling all rely on it (Gabbett, 2005; Johnston et al., 2014) Load the push and pull patterns progressively, do not leave upper body as an afterthought.

VELOCITY BASED TRAINING OR PERCENTAGE BASED TRAINING?

Once athletes are technically sound and progressing in their strength development, how load is prescribed becomes critical. Velocity Based Training (VBT) offers a practical way to ensure athletes are lifting appropriate loads with the right intent.

WHY VELOCITY MATTERS IN RUGBY LEAGUE

Rugby League performance depends on the ability to produce force quickly (Gabbett, 2005). Acceleration, contact dominance, tackling, and change of direction all require high levels of power, speed, and neuromuscular control (Johnston et al., 2014). VBT reinforces these demands by encouraging athletes to move external loads with intent, rather than simply completing a prescribed percentage (Wang et al., 2026).

Research shows VBT produces small but meaningful improvements in jump performance and change of direction (Wang et al., 2026; Zhang et al., 2023), with comparable outcomes to percentage-based training (PBT) for maximal strength and sprint speed (Wang et al., 2026). VBT does not replace traditional methods, it sharpens how they are applied.

STRENGTH TRAINING

WHY VBT IS VALUABLE FOR FEMALE ATHLETES

Female athletes present with varying training ages, broader differences in strength experience, and fluctuating tolerances to load and fatigue across the monthly cycle (Munteanu et al., 2026). Velocity based training allows coaches to respond to these differences in real time.

Rather than assuming readiness based on a historical one repetition maximum, VBT adjusts load according to how the athlete is performing on the day. This creates a more individualised approach, ensuring athletes are appropriately challenged while managing fatigue effectively (Zhang et al., 2023).

KEY DIFFERENCES IN APPROACH (PBT VS VBT)

Percentage Based Training:

- Based on historical 1RM
- Fixed load prescription
- Assumes readiness
- Less individualised day to day
- Simple to implement
- Fatigue less visible

V

Velocity Based Training:

- Based on real-time performance
- Auto-regulated loading
- Measures readiness
- Highly individualised
- Requires technology
- Fatigue highly visible





APPLYING VBT IN PRACTICE

VBT prescribes or adjusts load based on bar speed during the lift. Coaches target a velocity zone (a speed range that corresponds to the training goal, measured in metres per second) aligned to the training goal. For example, in place of Squat at 80% of 1RM; athlete is asked to squat in the 0.45-0.60m/s velocity zone.

If bar speed consistently exceeds the upper boundary of the target zone (for example, above 0.60 m/s across multiple repetitions), load can be increased. If bar speed falls below the lower boundary (for example, below 0.45 m/s), load should be reduced. A velocity loss threshold of 20% from the first repetition is commonly used to signal end of set, ensuring movement quality is maintained while managing fatigue (Wang et al., 2026).

Practical example: First repetition velocity = 0.60 m/s, coach dictates a 20% velocity loss threshold; therefore 'end of set' is approximately 0.48 m/s performance. This ensures that quality of movement is maintained while managing fatigue.

WHERE VBT FITS BEST

Squat variations, bench press, trap-bar deadlift, Olympic lifting derivatives, jump squats.

Velocity Based Training does not replace PBT. It enhances decision-making by providing real time feedback on performance, intent and fatigue. For female athletes, it supports a more responsive, individualised approach that aligns with the capacity to adapt and progress.

CONDITIONING

Several physiological differences mean that conditioning program designed primarily for male athletes may underserve female athletes:

1. Heart size and stroke volume: Female hearts are, on average, smaller in absolute terms, resulting in a lower stroke volume per beat. To achieve the same cardiac output as a male athlete at equivalent relative intensity, a female heart must beat at a higher frequency. Female athletes therefore commonly reach higher heart rates at comparable relative workloads (Costill et al., 1976; Wheatley et al., 2014).
2. Lung capacity: females have smaller lung volumes, which affects the volume of oxygen that can be exchanged per breath (Harms, 2006). This is a structural factor, not a performance ceiling.
3. Female athletes have proportionally more Type I muscle fibres than male athletes (Haizlip et al., 2015; Nuzzo, 2024). This supports greater fatigue resistance and aerobic efficiency at moderate intensities. At maximal and supramaximal intensities, where Type II fibre recruitment dominates, female athletes may show a steeper rate of power decline between repeated efforts compared to males, though absolute power output remains highly trainable (Dabbs et al., 2026).
4. The evidence on lactate threshold variation across the menstrual cycle is mixed. Hackney et al. (1994) reported substrate differences across cycle phases, while Galletti et al. (2025) found no significant differences in lactate threshold in untrained females. The practical implication is that coaches should monitor individual athlete responses rather than applying blanket phase-based modifications, consistent with the NSCA position (Dabbs et al., 2026b). Separately, female athletes typically reach their lactate threshold and maximal lactate steady state at a higher percentage of VO2max than male athletes, which has implications for heart-rate-based intensity prescription (Dabbs et al., 2026b).
5. Thermoregulation: during the luteal phase (the two weeks after ovulation), elevated progesterone raises resting core temperature by approximately 0.3-0.5 degrees Celsius (Sunderland & Nevill, 2003). This slightly raises the body's starting point, which can increase the perception of heat stress and affect tolerance to prolonged high intensity work in warm environments. Plan heat management accordingly during this phase.
6. Mitochondrial advantage: female athletes demonstrate approximately one-third greater mitochondrial respiration than male athletes, contributing to their aerobic efficiency and capacity to sustain moderate-intensity work. Coaches should frame this as a performance asset. Female athletes can sustain moderate-to-high intensity work longer between maximal efforts than their male counterparts, which has direct implications for how conditioning blocks are structured (Dabbs et al., 2026b).
7. Breathing rate and oxygen efficiency: female athletes tend to breathe at higher rates for the same oxygen uptake as males (Harms, 2006), which can contribute to respiratory fatigue during sustained high intensity efforts.

PRACTICAL CONDITIONING GUIDANCE

The core goal is to prepare female athletes for repeated high intensity bouts: multiple sprints, tackles, rucks, and recoveries within short time windows.

1. Repeated short high intensity intervals: intervals of 10-30 seconds at maximal or near-maximal effort, with 1:3 to 1:5 work-to-rest ratios, develop the repeat sprint quality the game demands (Gabbett, 2005). Example: 15 seconds hard sprint/effort, 60 seconds active recovery, repeated 8-12 times.
2. Aerobic base development: sustained moderate intensity sessions (60-75% of maximum heart rate for 20-40 minutes) build the foundation that allows recovery between high intensity bouts Laursen & Jenkins, 2002). Female athletes often respond well to this work given their fibre type profile.
3. Progression and periodisation: build aerobic base in the preseason, then shift to repeat sprint and high intensity interval work as the season approaches. Monitor athlete responses and be prepared to reduce intensity or volume in the days leading up to or during the early luteal phase if individual athletes report heightened fatigue.
4. Hydration and heat management: ensure athletes are well hydrated before conditioning sessions. In hot conditions, consider scheduling high intensity conditioning in cooler parts of the day during the preseason, and monitor athletes closely for heat-related distress.

Key message for coaches: Do not assume conditioning program designed for male athletes translate directly to female athletes. Female athletes benefit from high-intensity work but may need slightly longer recovery intervals and more attention to menstrual cycle phase effects on training tolerance (Munteanu et al., 2026; Dabbs et al., 2026b).

A recommended conditioning session template is provided in the Coach Manual (Section 10, Conditioning Session).



SPEED, CHANGE OF DIRECTION AND CONTACT PREPARATION



5.1 DECELERATION, LANDING CONTROL. BEGIN AT THE END

Before you teach athletes to run fast, teach them to stop safely.

The safest and most effective way to develop speed and change-of-direction ability is to start with control and build speed on top of it, not the other way around.

1. Always begin with deceleration (Jones et al., 2017; Nimphius et al., 2016). Key coaching cues: body drops low into the hips; forward lean with short quick steps to stop; knee remains aligned over the middle toe. (not collapsing inward).
2. Always practise landing before jumping or cutting (Hewett et al., 2006). Simple starting point: have athletes step off a low box onto one leg and hold the position for 3 seconds. Cues= Land softly, there should be minimal noise on contact with the ground. Bend the hip and knee to absorb the force. Hold the landing position. Knee stays over the middle toe, not collapsing in.
3. Train the small movements that make change of direction possible: Example drill: stand next to a pole, run around it as tightly as possible. Cues= Use small, controlled steps; stay as close to the pole as possible without touching it; torso stays upright over the knee; knee stays over the middle toe.
4. Add perturbation (unexpected pushes or knocks that challenge balance) once basic positions are controlled (Myer et al., 2006):

- Light chest contacts while maintaining balance
- Ankle level gentle contacts while in a single leg landing position
- Reaction based change of direction (COD) from a coach signal

5.2 SPRINT MECHANICS PREREQUISITES

Before progressing to COD work, coaches should check that the athlete can demonstrate competency in the following sprint mechanics. These are practical technique checkpoints rather than validated screening criteria (Seagrave et al., 2009):

- Knee flexion adequate for an efficient stride cycle
- Effective ground reaction force through the foot
- Low drag on the rear foot during the drive phase
- Short rear leg position during flight, with no long posterior stride
- Biomechanically efficient knee alignment
- Controlled, accurate foot placement at ground contact

If sprint mechanics are not yet established, COD and contact work is premature. Neuromuscular conditioning work should target these checkpoints directly before any COD speed work is introduced. Return to sprint mechanic drills, single-leg loading progressions and ground contact cue work until the athlete demonstrates consistent competency across all six points.

SPEED, CHANGE OF DIRECTION AND CONTACT PREPARATION

5.3 CONTACT PREP.

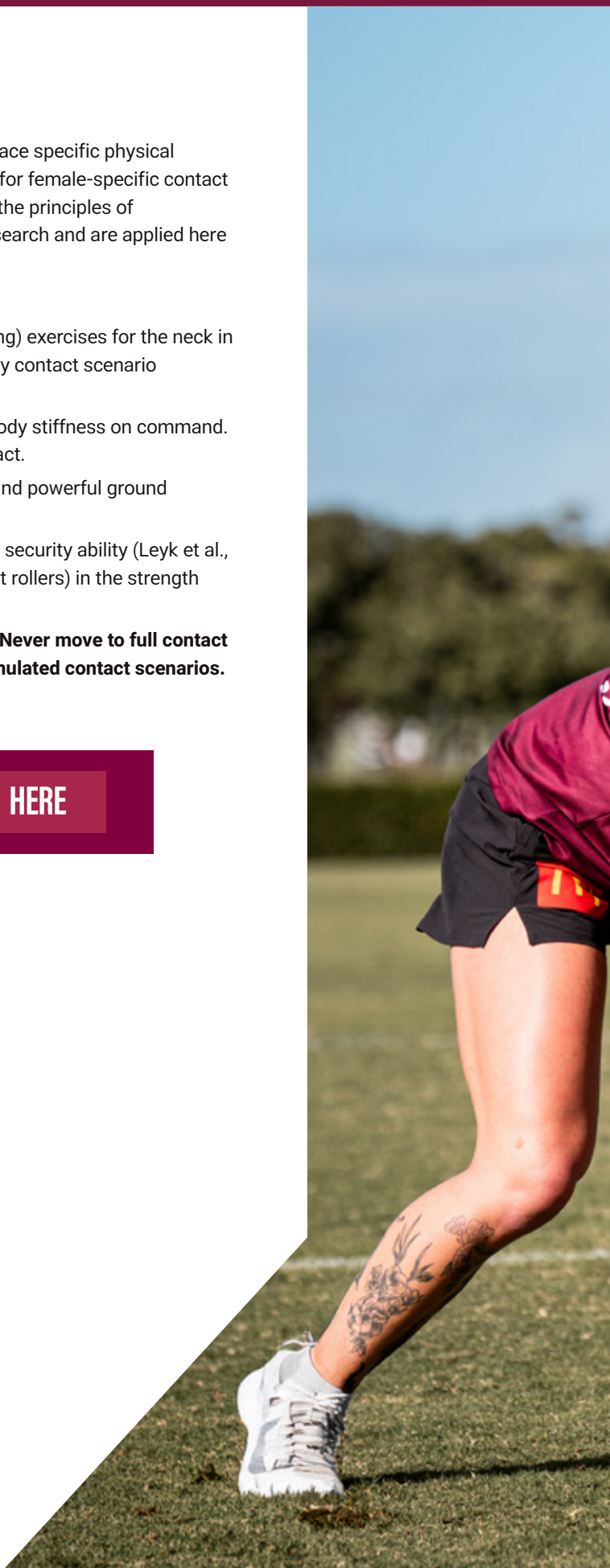
Contact situations, including tackling, being tackled, and the ruck, place specific physical demands on female rugby league athletes. While the evidence base for female-specific contact preparation in rugby league remains limited (Johnston et al., 2014), the principles of progressive contact loading are well established in contact sport research and are applied here to the female pathway.

Focus areas before adding contact loads:

1. Neck strength and bracing: progressively loaded isometric (holding) exercises for the neck in all directions. Athletes should be able to brace the neck before any contact scenario (Dezman et al., 2013; King et al., 2010).
2. Trunk and pelvis bracing: the athlete must be able to create full body stiffness on command. Practise bracing under load before practising bracing under contact.
3. Stride mechanics into contact: teach intentional high knee drive and powerful ground contact in the last 2-3 steps into a tackle or ball carry.
4. Hand grip strength: grip strength directly affects tackling and ball security ability (Leyk et al., 2007). Include grip specific exercises (hangs, farmer carries, wrist rollers) in the strength program.

For coaches: These elements should be introduced progressively. Never move to full contact before an athlete has demonstrated controlled body position in simulated contact scenarios.

VIEW THE RETURN TO CONTACT FRAMEWORK HERE



5



MENSTRUAL CYCLE CONSIDERATIONS

THE MENSTRUAL CYCLE

The menstrual cycle affects how female athletes feel, their motivation levels, and recovery (physical and mental) across the month. Some athletes will be significantly affected; others will notice little change.

The coach's job is not to manage the cycle, it is to create an environment where athletes can communicate their experience, and to have enough knowledge to respond appropriately.

SYMPTOMS ATHLETES MAY EXPERIENCE

1. Physical: Abdominal cramping, lower back pain, fatigue, headaches, bloating, breast tenderness.
2. Performance / motivation related: Reduced coordination, altered balance and neuromuscular control, slower reaction time, learning new skills.
3. Research suggests that resistance training strength and power outputs are not meaningfully impacted by cycle phase. A systematic review and meta-analysis of 78 studies found only a trivial reduction in exercise performance during the early follicular phase compared to all other phases, with no consistent effect across phases for strength or power outcomes (McNulty et al., 2020). Perceived effort and motivation, however, may be a driver of reduced output in some athletes (Munteanu et al., 2026).
4. Psychological: Irritability, fluctuating confidence, reduced concentration, emotional sensitivity.

These symptoms are real and can affect training and match performance. Treat them with the same practical response you would give to any other physical complaint.

HORMONAL CONTRACEPTION

For athletes using hormonal contraception, the natural hormonal fluctuations described above are altered, suppressed, or absent, depending on the type used:

- Combined oral contraceptive pill (COCP)
- Progestin only pill (minipill)
- Transdermal patch
- Vaginal ring
- Hormonal IUD (e.g., Mirena/levonorgestrel IUD)
- Contraceptive implant (arm rod)
- Contraceptive injection (e.g., Depo Provera)
- Copper IUD (non-hormonal, does not suppress the cycle)

For these athletes, the best guide is the athlete herself. She should be encouraged to monitor her own responses to training, nutrition, fatigue, and recovery throughout the month. Apps (e.g., FitrWoman, Clue), journalling, or a simple "good, ok, poor" diary each day can generate useful data over time.

GOOD COACHING PRACTICE

1. Encourage athletes to track their cycle, whether with an app, a calendar, or a simple emoji system. The "sad, mad, meh, or happy face" on a daily calendar is genuinely useful.
2. Brief education for athletes and coaches: a short conversation at the start of the season about what the cycle does to performance and recovery normalises the topic.
3. Discuss symptoms as you would discuss any training influence. If cramping were affecting an athlete's ability to train at full intensity, modify volume, shift to technical work, and prioritise recovery. This is just sensible athlete management. Additionally discuss how this may show up on game day, what strategies could be put in place to allow full game participation.
4. Create a safe environment for regular, frank conversations. Athletes should feel no embarrassment discussing their cycle, any more than they would discussing a sore hamstring.
5. Refer to medical if symptoms are severe and impacting both health and performance.

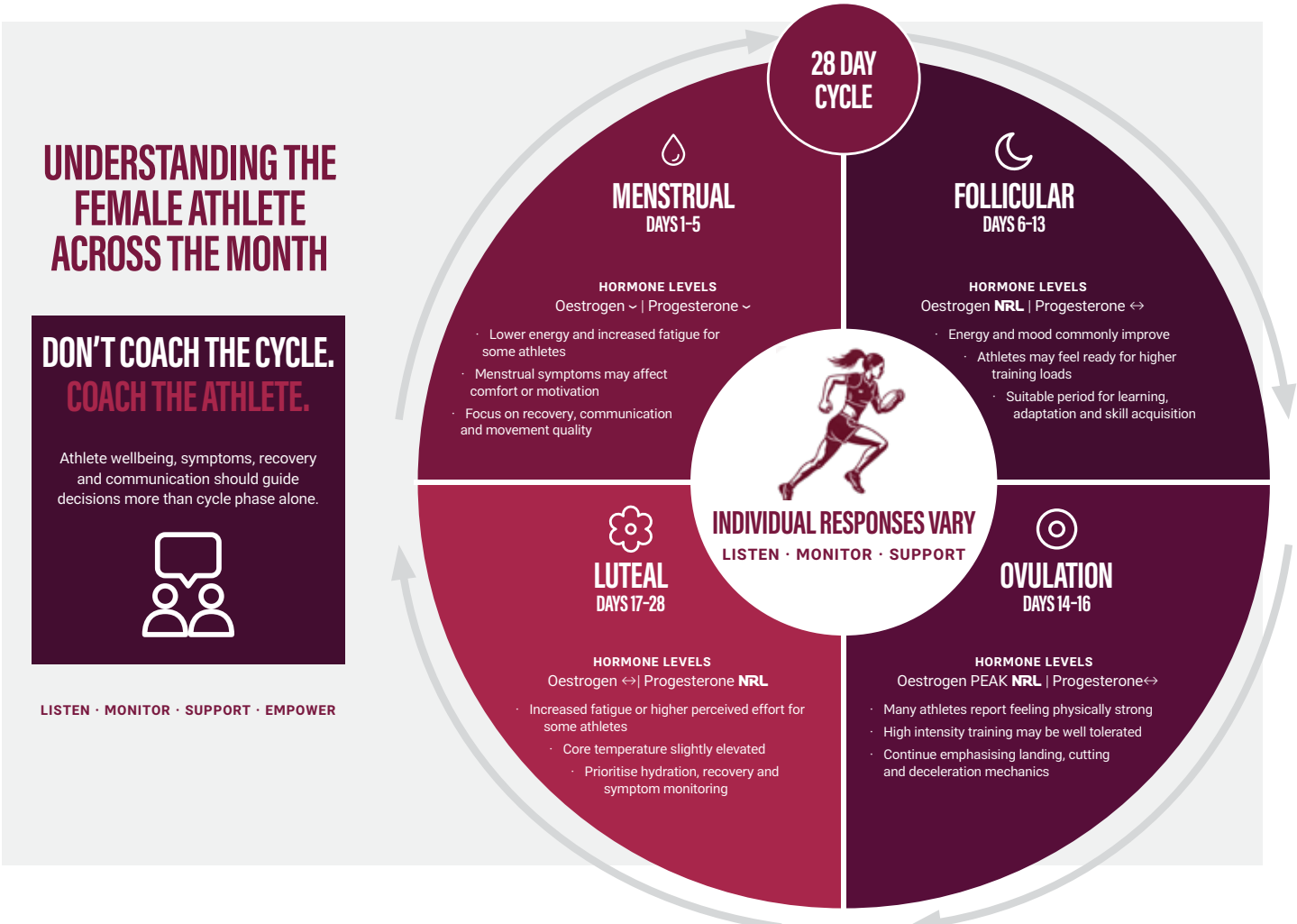
INJURY SUSCEPTIBILITY ACROSS THE CYCLE

Elevated oestrogen around and immediately before ovulation (approximately days 12-14 of a typical 28-day cycle) may increase ligament laxity, particularly at the knee. A systematic review of seven studies found a tendency toward greater ACL injury incidence during the preovulatory phase, when oestrogen is rapidly rising (Hewett et al., 2007;Herzberg et al., 2017). However, a more recent systematic review concluded that evidence is inconclusive as to whether any specific cycle phase meaningfully elevates non-contact ACL injury risk, due to low study quality and mixed findings (Dos Santos et al., 2023). The practical implication is that coaches should not modify training program based on cycle phase alone but should maintain high-quality neuromuscular control work consistently across the month.

Luteal phase (the two weeks after ovulation, leading up to the next period): progesterone raises resting core temperature by approximately 0.3 to 0.5 degrees Celsius (Sunderland and Nevill, 2003), which can increase the perception of heat stress and fatigue, particularly during high-intensity conditioning in warm environments. Some athletes report reduced neuromuscular coordination and slower recovery during this phase. The practical response is to monitor athlete-reported wellness and adjust session intensity or volume where needed, rather than pre-emptively restricting training.

Menstrual phase (the bleed itself): oestrogen and progesterone are at their lowest. Some athletes experience significant symptoms in the first one to two days while others train at full capacity without issue (McNulty et al., 2020). Individual response is the most reliable guide.

Energy metabolism, recovery needs, and nutritional requirements shift across the cycle. This is particularly relevant around the luteal phase, when some athletes have elevated carbohydrate needs and increased perceived exertion at a given intensity (Mountjoy et al., 2023). Coaches should ensure athletes are not under-fuelling, particularly during high-load training weeks.



MENSTRUAL CYCLE CONSIDERATIONS



FEMALE ATHLETE VERTEBRAL BONE DENSITY AND RED-S

Female vertebrae are naturally smaller and less dense than male vertebrae from puberty, and therefore the baseline bone reserve for females is lower before training even begins.

Bone density depends on adequate energy availability. When a female athlete consistently burns more than she consumes, bone formation slows and resorption increases.

RED-S (Relative Energy Deficiency in Sport) builds on and broadens the Female Athlete Triad.

The result is compounding vulnerability: naturally less dense vertebrae + energy deficiency + low oestrogen leads to:

1. Elevated modifiable risk of vertebral bone stress injuries and compression fractures, even in young athletes
2. Neuromuscular motor learning capacity reduced
3. Skill acquisition capacity reduced

For coaches: You do not need to know the details of an athlete's contraception. You need her to feel comfortable telling you when she is having a difficult week.

ENERGY AVAILABILITY DRIVES HEALTH, PERFORMANCE AND LONG-TERM SUCCESS.

OPTIMAL ENERGY AVAILABILITY

PERFORMANCE PATHWAY

1. FUEL
Adequate energy intake to meet training demands and support daily function.

2. RECOVERY
Quality sleep, nutrition and recovery strategies restore the body and mind.

3. ADAPTATION
The body adapts and becomes stronger, more resilient and efficient.

4. PERFORMANCE
Optimised performance, consistency and long-term development.

EAT ENOUGH. RECOVER WELL. PERFORM BETTER.

RED-S

RELATIVE ENERGY DEFICIENCY IN SPORT

When energy intake is consistently too low for training and daily life, the body down-regulates non-essential functions to survive.

POTENTIAL IMPACTS

- HORMONAL HEALTH
- MENTAL HEALTH
- BONE HEALTH
- METABOLIC HEALTH
- IMMUNE FUNCTION
- REPRODUCTIVE HEALTH

LOW ENERGY AVAILABILITY (RED-S)

RISK PATHWAY

1. UNDER-FUEL
Not enough energy to support training, recovery and normal body function.

2. HORMONAL DISRUPTION
Hormones that regulate recovery, mood, bone health and reproduction become disrupted.

3. FATIGUE
Persistent tiredness, poor recovery, reduced adaptation and increased perceived effort.

4. INJURY RISK
Reduced tissue resilience, impaired immunity and poor recovery increase injury risk.

UNDER-FUEL TODAY. UNDER-PERFORM TOMORROW. HIGHER RISK OF INJURY.

COACH THE WHOLE ATHLETE. FUEL, MONITOR AND SUPPORT.

STRONGER TOGETHER. BUILT FOR HER GAME.

MONITOR
Track wellbeing, symptoms and performance.

COMMUNICATE
Create open, respectful and regular conversations.

SUPPORT
Individualise, educate and empower every athlete.

FLEXIBILITY AND MOBILITY

Key Principle: Build strength through control across range

Female athletes are more likely than male athletes to present with generalised joint hypermobility. Across collegiate sport, the prevalence of generalised joint hypermobility in female athletes is approximately 42%, compared to 17% in male athletes, with females 3.4 times more likely to meet hypermobility criteria (Nicolay et al., 2023). In contact team sports specifically, female rugby players show rates of localised joint hypermobility exceeding 57%, compared to 46% in male rugby players. This is not a disadvantage in isolation, but it does mean the priority for female athletes is not to increase range further. It is to develop the strength and control to manage the range they already have.

Training focus therefore shifts from passive lengthening to active control, building strength at end-range positions so athletes can express movement efficiently and safely under the speeds and loads of competition.

A practical example is the shoulder joint. The goal is not to increase range further, but to develop the rotator cuff and scapular stabilisers to control the shoulder through that full movement under load. The athlete performs a slow eccentric dumbbell press to end range, a banded external rotation hold at 90 degrees abduction, or a cable face pull with a controlled pause at full retraction. Each exercise demands active muscular control at the positions where passive range already exists.

For the lower limb, the same principle applies directly to ACL modifiable risk factors. The hip abductors, gluteal complex, and knee stabilisers must be strong and active through the full range of a landing, cutting, or deceleration movement. Passive range without active control at end range is where soft tissue loading concentrates.

The outcome is an athlete who is not just mobile, but stable and strong through her entire available range, reducing the demand placed on passive structures such as ligaments and joint capsules under sport-specific forces.

SEQUENCING: WHEN TO DO WHAT

The order of mobility and stretching work within a session matter and is frequently misunderstood.

Before arriving on the field (pre-session): Foam rolling, physiotherapy treatment, strapping. These are preparatory and passive. Get them done before any active preparation begins.

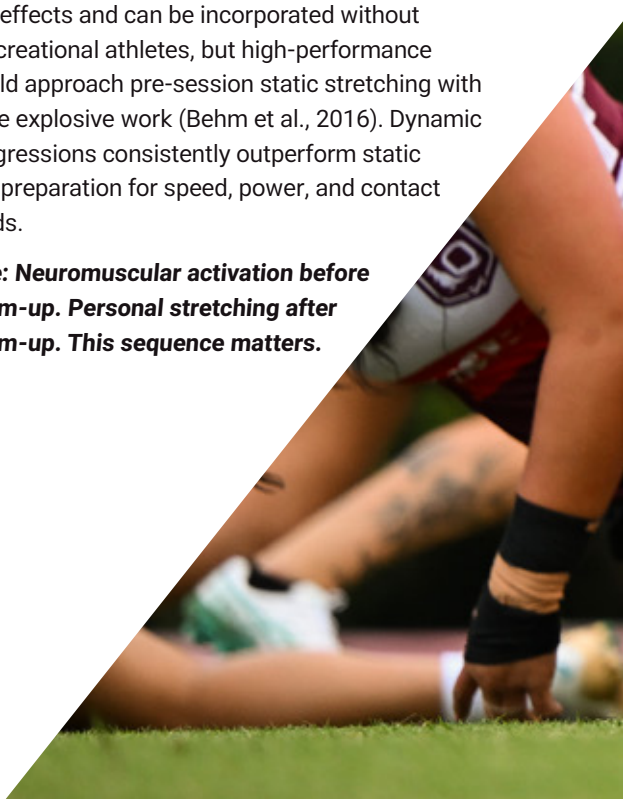
Before the warm-up (on the field): Neuromuscular activation work (see Section 2). The goal here is to signal the brain to activate specific muscles precisely, using slow and deliberate movements. This builds ankle stiffness for landing, activates the hip abductors and extensors, and connects the trunk to the lower limb before any dynamic activity begins.

Warm-up: Progress from low-intensity movement to game speed activity using your standard warm-up progression.

Immediately after the warm-up (but before intense work): Athletes may perform their preferred personal stretches and movement feel routines. This is the window for any dynamic or static stretching that feels good to the individual. It should not occur before neuromuscular activation work.

The evidence on pre-exercise static stretching is now well established. Static stretching held for more than 60 seconds per muscle group produces meaningful reductions in subsequent strength and power output (4 to 7.5%) and reduces neuromuscular activation quality before explosive activity (Behm et al., 2016; Simic et al., 2013). Short-duration static stretching under 60 seconds produces only trivial performance effects and can be incorporated without concern in recreational athletes, but high-performance athletes should approach pre-session static stretching with caution before explosive work (Behm et al., 2016). Dynamic warm-up progressions consistently outperform static stretching as preparation for speed, power, and contact sport demands.

Key message: Neuromuscular activation before the main warm-up. Personal stretching after the main warm-up. This sequence matters.



7



RECOVERY

KEY 1: SLEEP

Sleep is when the brain consolidates motor learning, clears metabolic waste, and regulates hormones (Diekelmann and Born, 2010; Xie et al., 2013). For female athletes, the stakes are higher. Sleeping fewer than eight hours per night increases injury risk, accelerates neuromuscular decline, and is linked to higher rates of anxiety and depression (Charest and Grandner, 2020).

The numbers are clear. Athletes sleeping under eight hours are 1.7 times more likely to sustain a musculoskeletal injury (Milewski et al., 2014). In female collegiate athletes, each additional hour of sleep reduced next-day injury risk by 43% (Haraldsdottir et al., 2021). A 2025 cohort study found that female athletes sleeping eight or more hours had 84% lower injury odds, and critically, this protective effect was not observed in male athletes in the same cohort (Abrahamson et al., 2025). Sleep is a sex-specific performance variable.

Standard: Eight hours minimum, consistent sleep and wake times, and napping treated as a legitimate recovery tool when night sleep is disrupted.

KEY 2: HYDRATION

Replace fluids promptly after training. Water is sufficient for most sessions. Electrolytes become important for sessions lasting 60 to 75 minutes or training with significant heat load. Athletes should aim to replace what they lose plus a little more so that their urine is pale yellow (not dark yellow).

Dark urine at the start of a session means the athlete arrived under-hydrated. Neuromuscular function and decision-making are already compromised before training begins (Sawka et al., 2007).

KEY 3: NUTRITION

Food is fuel for repair. Under-fuelling is a genuine risk in high-training-load environments and can lead to Relative Energy Deficiency in Sport (RED-S), which impairs bone health, hormonal function, immunity, and performance (Mountjoy et al., 2023).

If an athlete is persistently fatigued, losing weight unintentionally, or experiencing menstrual irregularities, she may not be eating enough, and referral to a dietitian is recommended.

Practical note for coaches: Travel schedules, early sessions, and training camps routinely create under-fuelling conditions. This is a logistics problem, not a willpower problem. Create opportunities to eat pre-session snacks, post-session recovery meals, and food access during travel. An athlete who is consistently under-fuelled will not adapt positively to load, regardless of how good the program is.

KEY 4: POST GAME AND POST SESSION MODALITIES

Contrast showers: Alternate warm and cold water three to five times. The key word is comfort. Low cost, accessible, well tolerated.

Cold water immersion (ice baths): The evidence for ice baths in female athletes is limited and mixed (Wellauer et al., 2025). The only randomised controlled trial conducted specifically in women found that both cold and hot water immersion produced zero measurable benefit over passive rest across four recovery markers: muscle strength, muscle soreness, swelling, and inflammation (Wellauer et al., 2025). Most cold-water immersion research has been conducted in male populations, and sex-specific protocols remain largely unstudied (Hutchins et al., 2022). Ice baths are not harmful if athletes prefer them, but coaches should not prioritise them oversleep, nutrition, and team connection.

Pool recovery: Water walking and pool-based recovery are effective tools for lower limb soreness (Versey et al., 2013). The deeper the water, the greater the hydrostatic pressure, which supports blood flow and reduces swelling.

KEY 5: MENTAL RECOVERY

Physical and mental recovery are not separate. Female athletes carry the same cognitive and emotional load as male athletes, plus the physiological fluctuations of the menstrual cycle. Recovery environments matter. Athletes should not be expected to perform emotionally at every session, genuine rest days should function to allow downtime from all football related activities physical
and cognitive.

KEY 6: CONNECTION TO TEAM AND COACHES

Connection to team and coaches is not a bonus for female athletes. It is a recovery mechanism, and the evidence is as strong as the evidence for sleep.

The quality of the coach-athlete relationship is one of the most significant determinants of a female athlete's psychological wellbeing, willingness to disclose injury and fatigue, and long-term engagement with the sport (Kernan et al., 2025). When that relationship is absent or harmful, the consequences of anxiety, concealed injury, and disengagement become real issues. Female athletes who report their coach as a source of stress are at significantly greater risk of overuse injury across a season (Pensgaard et al., 2018).

Belonging to a team provides meaning, shared identity, and resilience that no physical modality can replicate (Stevens et al., 2024). Stronger social identification with the team predicts greater wellbeing and resilience across a competitive season (Stevens et al., 2024).

An athlete who trusts her coach will tell you she is not coping before it becomes a crisis. An athlete who belongs to her team will push through adversity rather than disengage. These are not soft outcomes. They are the differences between an athlete who stays in the sport and one who does not.

In practice:

- Check in with every athlete at the start of every session. Not about training but about her. Thirty seconds. Its beneficial effect compounds over a season.
- When an athlete is injured, keep her connected to the team. Her place in the group is not contingent on her physical output.
- Frame achievements as collective. An athlete who feels she belongs to something larger than herself has greater psychological resources to persist through adversity, maintain training engagement, and remain in the sport during difficult periods (Stevens et al., 2024; Evans et al., 2023).
- Recognise that for many young women, a trusted coach is the first adult outside their family who takes their physical experience seriously. That trust, once earned, is one of the most powerful performance and recovery assets you have.
- Coaches and Performance staff should work together to ensure recovery practices are applied at the appropriate times based on the periodised plan and game schedule to ensure adaptation to training continues.

Key message: The environment you create determines whether athletes recover well, disclose early, and stay in the sport. Connection is not a personality trait. It is a coaching skill. Treat it with the same seriousness you give to sleep, nutrition, and physical loading.



OPTIMAL ADAPTATION TO TRAINING AND SLEEP

WOLFF'S LAW: BONE RESPONSE TO LOADING

Bone is a living tissue that constantly remodels itself in response to the mechanical forces placed on it (Frost, 1994). When load increases, bone lays down new material and becomes stronger. When load decreases, bone is resorbed and becomes weaker.

Growth hormone is the key hormonal driver of bone remodelling and repair (Stich et al., 2022). The mechanical stimulus of exercise during the day signals the bone to adapt, but the actual repair and laying down of new bone material happens during sleep, when growth hormone secretion peaks during slow-wave sleep (Costa et al., 2022).

What this means in practice: Every impact session, sprint block, and plyometric repetition is a signal to bone. That signal only becomes adaptation if the athlete sleeps. A chronically under-slept athlete is being exposed to the loading stimulus without receiving the adaptation.

DAVIS'S LAW: SOFT TISSUE ADAPTS TO TENSION

Just as bone responds to compressive load, soft tissue adapts along the lines of tension it is regularly subjected to (Frost, 1994). Tendons, ligaments, and fascia remodel in response to the mechanical demands placed on them. When progressive tensile load (a pulling or stretching force) is applied consistently, connective tissue becomes stronger, stiffer, and better able to transfer force. When load is absent or insufficient, soft tissue loses capacity.

For female athletes, this is particularly relevant. Lower baseline tendon stiffness and greater joint laxity mean that progressive, well-sequenced loading is essential to build the connective tissue capacity needed to support joint stability under sport-specific demands. Muscles adapt quickly. Tendons and ligaments do not. The training program must allow time for soft tissue to keep pace with muscular gains.

MUSCLE: USE IT OR LOSE IT

When a muscle is not regularly loaded, it begins to atrophy. Muscle fibres decrease in size as structural proteins are broken down and not replaced. The rate of protein breakdown exceeds the rate of protein synthesis, and the result is loss of muscle mass, strength, and power. This process is governed by three principles:

- **Use It or Lose It:** muscles not regularly challenged will reduce in size and strength.
- **SAID Principle (Specific Adaptations to Imposed Demands):** the body adapts precisely to the demands placed on it, no more and no less.
- **Principle of Reversibility:** training gains are not permanent, and stopped training will result in gradual loss of the adaptations achieved.

Muscle protein synthesis, the process of building new muscle tissue in response to training, peaks during sleep. A single night of sleep deprivation reduces muscle protein synthesis by 18%, increases cortisol by 21%, and decreases testosterone by 22%, creating a pro-catabolic environment that persists into the following day (Lamon et al., 2021). An athlete who trains hard but sleeps poorly is breaking muscle down faster than she is building it back up (Yang et al., 2019).



SLEEP AND WASTE REMOVAL

Every training session generates waste: dead cells, damaged proteins, metabolic byproducts, and worn-out organelles that accumulate in muscles and soft tissues during exercise. The body removes this waste through three primary mechanisms: phagocytosis (where specialised immune cells clear damaged tissue from the site), autophagy (the process by which cells break down and recycle their own damaged components), and lymphatic drainage (Acheson et al., 2025).

If waste is not cleared efficiently, it accumulates in tissues, impairing muscle repair, reducing force production, and disrupting cellular homeostasis (Acheson et al., 2025; Call & Nichenko, 2020). This is not just a recovery issue. It is a performance issue.

During sleep, all three waste removal mechanisms are upregulated. The glymphatic system, the brain's dedicated waste clearance network, is largely inactive during wakefulness and becomes highly active during sleep, flushing toxic proteins and metabolic byproducts from the central nervous system (Xie et al., 2013; Lewis, 2021). Chronic sleep deprivation impairs this clearance and may contribute to long-term neurological risk (Wafford, 2021).

THE UNIFYING MESSAGE

Wolff's Law, Davis's Law, muscle atrophy principles, and waste removal mechanisms all lead to the same conclusion:

The body adapts to demand during the day and repairs, rebuilds, and cleans itself at night. Training provides the stimulus. Sleep delivers the adaptation. Neither works without the other.

- Chronic sleep deprivation does not just make athletes tired. It actively suppresses protein synthesis, elevates cortisol, impairs glymphatic clearance, and reverses the adaptations that training is designed to create (Lamon et al., 2020; Charest and Grandner, 2020).
- Eight to ten hours is the recommended sleep duration for adolescent athletes (Mason et al., 2023). Adult athletes should target a minimum of eight hours as a non-negotiable component of the training program (Charest and Grandner, 2020).



COACH QUICK REFERENCE TABLE

Each Table maps factors relating to a coaching action when considering biological, psychological and social factors.

ANATOMICAL DIFFERENCES

Factor	What it means physically	Watch for in session	Immediate coaching action	Female Athlete Framework
Greater Q-angle	Wider pelvis creates a greater inward pull on the knee. More lateral force on the patella during cutting, landing, and jumping.	Knee drops inward on landing, squat, or deceleration. Patella tracking complaints.	Cue "knees over second toe" on every landing and squat. Prioritise hip abductor and glute activation before loading. Use mirror or video feedback early.	*Sect.1 Anatomy* *Sect.2 NMC*
Lower tendon stiffness & greater joint laxity	Tendons are less stiff; ligaments allow more joint travel. More flexibility but less passive stability — muscles must do more work to stabilise joints.	Excessive range at end of movement (hyperextension at knee/elbow). Joint "giving way" sensation. Slower force transfer under load.	Sequence loading: bodyweight banded loaded. Never skip stability phases. Prioritise single-leg and perturbation work to build active stability.	*Sect. 1 Anatomy* *Sect. 7 Flexibility*
Reduced rotational stability	Hip anatomy and Q-angle combined create a tendency for the knee to rotate inward under load, especially at fatigue.	Knee caves during plyometrics, COD, or late in session. Worsens with fatigue.	Include hip external rotation cues in all lower-body exercises. Add perturbation training in Phases 3–4. Monitor mechanics in the final third of every session — that is when risk is highest.	*Sect. 1 Anatomy* *Sect. 5 COD*
Higher proportion of Type I muscle fibres	Greater endurance capacity, slower to fatigue. Less explosive power reserve compared to male athletes with higher Type II fibre proportion.	Athletes maintain technique well for longer but may lack peak power in final sprint or contact moments. Do not mistake endurance for strength adequacy.	Include true maximal-effort sessions (not just high-rep). Program plyometrics and velocity-based work to develop Type II fibre recruitment. Measure power output — do not rely on visual assessment alone.	*Sect. 1 Anatomy* *Sect. 5 COD*

HORMONAL DIFFERENCES

Oestrogen fluctuation across menstrual cycle	Oestrogen peaks in late follicular phase. Affects tendon laxity, neuromuscular control, and tissue recovery. Antioxidant and anti-inflammatory properties support recovery when levels are high.	Increased ligament laxity and reduced neuromuscular activation in late luteal/early follicular phases. Athletes may report feeling "off" or less stable.	Track cycle phases for each athlete. Pay extra attention to landing and cutting quality from the follicular to ovulatory phases, and adjust for individual symptoms in the late luteal phase. Do not reduce load by phase alone.	*Sect.6 Menstrual Cycle*
Progesterone effects on fatigue & thermoregulation	Elevated progesterone in luteal phase raises resting core temperature and increases perceived exertion at the same absolute workload. Fatigue perception shifts.	Athlete reports unusual fatigue or breathlessness at a load she normally handles. Higher RPE without performance decline. Increased sweat rate.	Use RPE-based load management in luteal phase. Increase hydration opportunities. Do not interpret higher RPE as lack of effort — adjust session expectations accordingly.	*Sect. 4 Conditioning* *Sect.6 Menstrual Cycle*
Lower testosterone baseline	In developing athletes, testosterone drives protein synthesis and explosive power. Female athletes have 10–20x lower levels than male athletes, meaning muscle hypertrophy is harder to achieve and slower.	In developing athletes, slower strength gains than male peers at equivalent training loads. More time needed to build muscle mass. Do not interpret this as poor effort or non-compliance.	Set realistic timelines: strength adaptation in female athletes requires longer and more consistent exposure. Reward consistency and quality of movement, not speed of hypertrophy. Prioritise progressive overload.	*Sect. 3 Strength*
RED-S risk (Relative Energy Deficiency in Sport)	Under-fuelling suppresses hormonal function, impairs bone remodelling, reduces immunity, and degrades performance. Common in high-training-load environments.	Persistent fatigue, unintentional weight loss, menstrual irregularities, recurring illness, or stress fractures.	Create structured eating opportunities (pre/post session, travel). Ask about menstrual regularity as a routine health marker — not a personal question. Refer to dietitian if RED-S indicators are present.	*Sect. 8 Recovery*

NEUROMUSCULAR DIFFERENCES				
Delayed muscle activation at the knee (reduced pre-activation)	Female athletes show delayed or reduced quadriceps and hamstring co-activation before ground contact, increasing ACL load during landing.	Stiff, upright landings with minimal knee bend. Knee extended on initial contact during jumps or sprints.	Cue "soft landing" with knee and hip flexion on every jump. Use slow-motion landing drills before progressing to reactive speed. Phase 1 NMC must be completed before plyometric loading.	*Sect. 2 NMC* *Sect. 5 COD*
Hip-dominant vs knee-dominant loading strategy	Female athletes tend to absorb ground forces through the knee rather than sharing load across hip, glute, and trunk. This overloads the knee joint.	Athlete "sits into" the knee during deceleration or squat. Glutes inactive — felt as quads fatigue before posterior chain.	Use glute activation every session (banded clamshells, hip thrusts, bridges) before any loaded movement. Cue "push the ground away through the hip" during deceleration. Add Nordic hamstring curls weekly.	*Sect. 2 NMC* *Sect. 3 Strength*
Fatigue-driven neuromuscular collapse	As session fatigue accumulates, protective neuromuscular patterns deteriorate earlier in female athletes than in male athletes at equivalent relative loads.	Knee valgus worsening in final drills. Landing technique deteriorating after the 45-minute mark. Increased complaints of knee or ankle discomfort in the last third of session.	Monitor movement quality — not just output — in the final 20 minutes. Apply a "technique rule": if landing or cutting mechanics deteriorate, reduce intensity before reducing volume. Pre-emptive substitution, not reactive injury management.	*Sect. 4 Conditioning* *Sect 5 COD*
PSYCHOLOGICAL & SOCIAL FACTORS				
Coach-athlete relationship quality	For female athletes, the quality of the coaching relationship is one of the strongest predictors of injury disclosure, training adherence, and long-term sport participation.	Athlete does not report pain or fatigue. Sudden disengagement. Increased absence from training.	Check in with each athlete individually at the start of every session — not about training, but about her. Thirty seconds. Create a safe channel for disclosure. This is a coaching standard, not an optional extra.	*Sect. 8 Recovery*
Team belonging as a recovery mechanism	Social identification with the team provides psychological resources — meaning, resilience, and shared identity — that no physical modality can replicate. Injured athletes who remain connected recover faster.	Injured athlete withdrawing from team environment. Athlete who is de-selected becoming disengaged or leaving the sport.	When an athlete is injured, keep her in the team environment. Involve her in sessions wherever possible. Frame achievements as collective. An athlete who belongs to something larger than herself will push through adversity rather than disengage.	*Sect. 8 Recovery*

COACH MANUAL



This section translates the principles covered throughout this Female Athlete Framework into direct coaching application, including session structures, exercise selection, movement quality cues, and responses to common real-world coaching scenarios. It is designed to layer female-specific understanding onto your existing coaching practice, so your female athletes get more from every session.

HOW TO USE THIS SECTION

This section is organised as a practical sequence. Work through it in order during planning or jump to the part you need during a session.

- The quick-reference table on the preceding page is your first point of call mid-session. It maps each anatomical and hormonal difference to a specific, immediate coaching action.
- The Stage-Based Development table below tells you where to pitch your program for each cohort.
- The Minimum Environment Standards tell you what your club needs to have in place before running a female athlete training program.
- The Session Examples give you ready-to-use structures for NMC, strength, conditioning, and change-of-direction sessions, each with coaching cues written specifically for female athletes.
- The Reading the Athlete tool is a three-step process for adjusting training load based on how each athlete presents on the day, including fatigue, cycle phase, sleep, and injury status.
- The Scenario Responses give you a direct decision and action for the six most common situations you will encounter when coaching female athletes.

None of this replaces your coaching judgment. It is designed to inform it.

Assess and identify where each athlete is skill and ability wise, not where her age suggests she should be.

STAGE-BASED DEVELOPMENT

Function	U17	U19	Open/BMD
NMC Training	Phase 1-2: pattern learning, bodyweight, slow tempo. Focus on motor learning.	Phase 2-3: load and integrate. Bands, single-leg demand, unstable surfaces.	Phase 3-4: integrate and express. Reactive cues, sport-speed, max voluntary contraction.
Strength	Master bodyweight squat, hinge, single-leg balance before external load. Light bands, low loads.	Add external load progressively. Compound lifts with good technique. Introduce VBT concepts.	Full periodised strength program. VBT or percentage training. Heavier loads, sport specific.
Conditioning	Aerobic base. Short repeat efforts. Build capacity gradually.	Repeat sprint and HIIT. Game-specific conditioning. Monitor cycle effects.	Sport-specific repeat high-intensity work. Periodised across season. Individualised.
Speed and COD	Teach deceleration and landing first. Slow, controlled change of direction.	Add reactive elements. Light perturbation. Build speed on controlled base.	Full reactive change of direction. Sport-specific drills. Maximum velocity work.
Contact Preparation	Neck bracing, trunk stiffness. No full contact until controlled positions demonstrated.	Progressive contact loads. Simulated contact scenarios with control.	Full contact preparation. Grip strength, neck strength, stride mechanics into contact.
Cycle Awareness	Introduce the conversation. Normalise tracking. Teach phase basics.	Active tracking. Adjust training based on phase. Open discussion of symptoms.	Individualised cycle-informed programming. Athletes self-manage with coach support.
Recovery	Sleep education (8+ hours). Hydration basics. Nutrition fundamentals.	Structured recovery routines. Post-session modalities. Mental recovery practices.	Individualised recovery. Monitor sleep, nutrition, hydration. Refer as needed.
Coach Knowledge Required	Anatomy basics, cycle basics, RED-S awareness, safe progression principles.	NMC programming, VBT introduction, cycle-informed training, injury referral pathways.	Full periodisation, VBT, advanced cycle programming, RED-S management, multidisciplinary referral.

RECOMMENDED MINIMUM ENVIRONMENTAL STANDARDS

Clubs vary significantly in resources, staffing, and facilities. Below is the minimal environmental baseline recommended for every club developing the female athlete.

EQUIPMENT

Item	Minimum Required	Why It Matters
Resistance bands	Light, medium, and heavy	Required for NMC progression across all four phases. Without bands, Phase 2 onwards cannot be delivered correctly.
Low box or step	15 to 35 cm height	Required for step-down and landing practice. The highest-specificity NMC exercise in the program.
Foam pad or balance mat	One per athlete or shared rotation	Required for Phase 3 and 4 NMC progressions involving unstable surfaces.
Flat open space, cones, foam rollers	Adequate space for movement	Required for warm-up, COD drills, and pre-session tissue preparation.

SUGGESTED STAFFING

Item	Minimum Required	Why It Matters
Physiotherapy contact	Named person or documented referral pathway	Required for injury assessment and management. Every club must know who an injured athlete goes to and how quickly.
Menstrual health referral	Named GP or sports physician	Required for athletes with cycle concerns or suspected RED-S. This is not optional for programs running U17 and above.
Injury referral pathway	Documented escalation from coach to medical professional	Required for managing niggles before they become injuries. Undocumented referral pathways are not referral pathways.
Injury reporting log	Simple written record of injuries and niggles	Required to identify patterns across athletes and sessions. One injury is a data point. Three in the same location across three athletes is a program problem.
Female wellbeing officer	Named person athletes can speak to confidentially	Required for all programs. Critical for U17 and younger. Athletes must know who this person is before they need them.



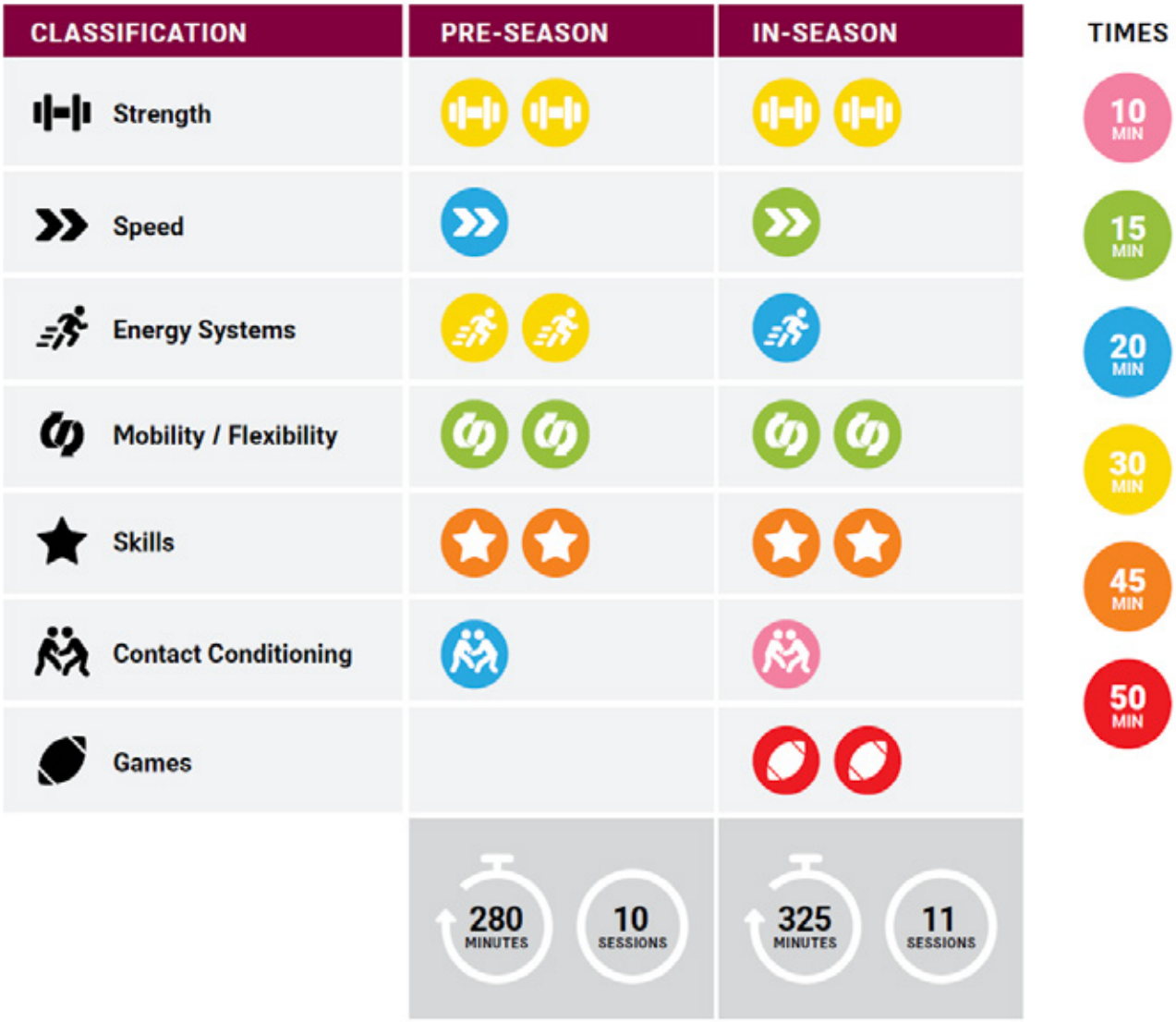
10



COACH MANUAL - SUGGESTED TRAINING EXPOSURES

13 YEARS. FEMALE ATHLETES

(Image from QRL Physical Performance Framework)



Example of three weekly block is over page

Document note:

NMC (15 minutes) opens every session regardless of session type. This is intentional. Neuromuscular control is not a gym-only requirement for female athletes. Beginning every session with consistent NMC preparation builds the movement habits that underpin performance in strength, conditioning, speed, contact, and skills alike.

Pre-Season Block, Under 13 Female Athletes

QRL Physical Performance Framework + NMC Layer (15 min every session)

WEEK 1

Day	Components	Duration
Monday	NMC (15 min), Strength, Mobility	60 min
Wednesday	NMC (15 min), Energy Systems, Speed	65 min
Friday	NMC (15 min), Skills, Contact Conditioning	65 min
Week 1 total: 190 min, 3 sessions		

WEEK 2

Day	Components	Duration
Monday	NMC (15 min), Strength, Mobility	60 min
Wednesday	NMC (15 min), Energy Systems, Speed	65 min
Friday	NMC (15 min), Skills	50 min
Week 2 total: 175 min, 3 sessions		

WEEK 3

Day	Components	Duration
Monday	NMC (15 min), Strength, Mobility	60 min
Wednesday	NMC (15 min), Conditioning, Speed	65 min
Friday	NMC (15 min), Skills, Game Simulation	55 min
Week 3 total: 180 min, 3 sessions		

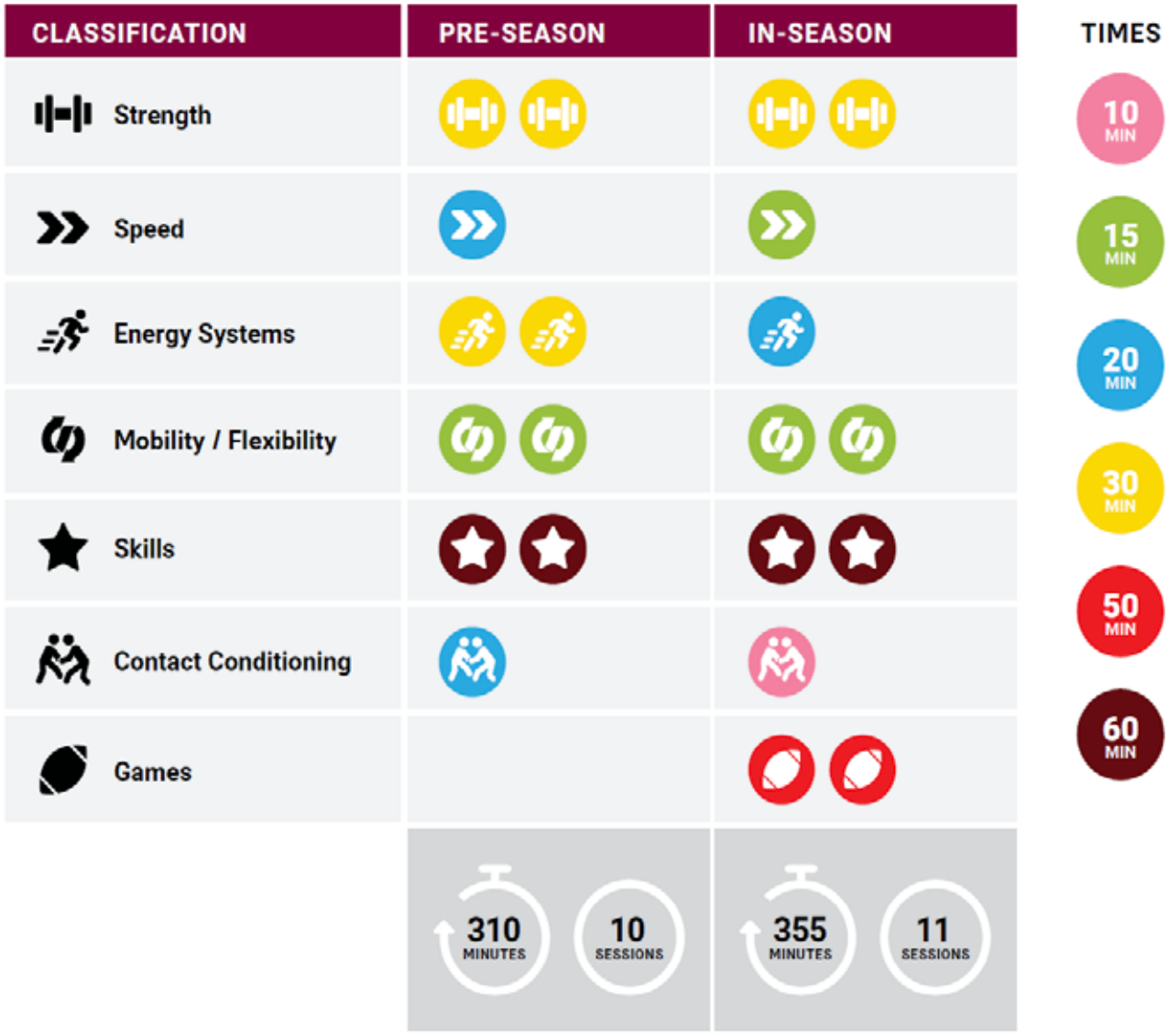
BLOCK SUMMARY

Week	Sessions	Minutes	Key Focus
1	3	190	Introduce NMC, establish strength base, first contact exposure
2	3	175	Consolidate strength, lift conditioning intensity, build skills volume
3	3	180	Peak conditioning, speed, game-context skills

COACH MANUAL - SUGGESTED TRAINING EXPOSURES

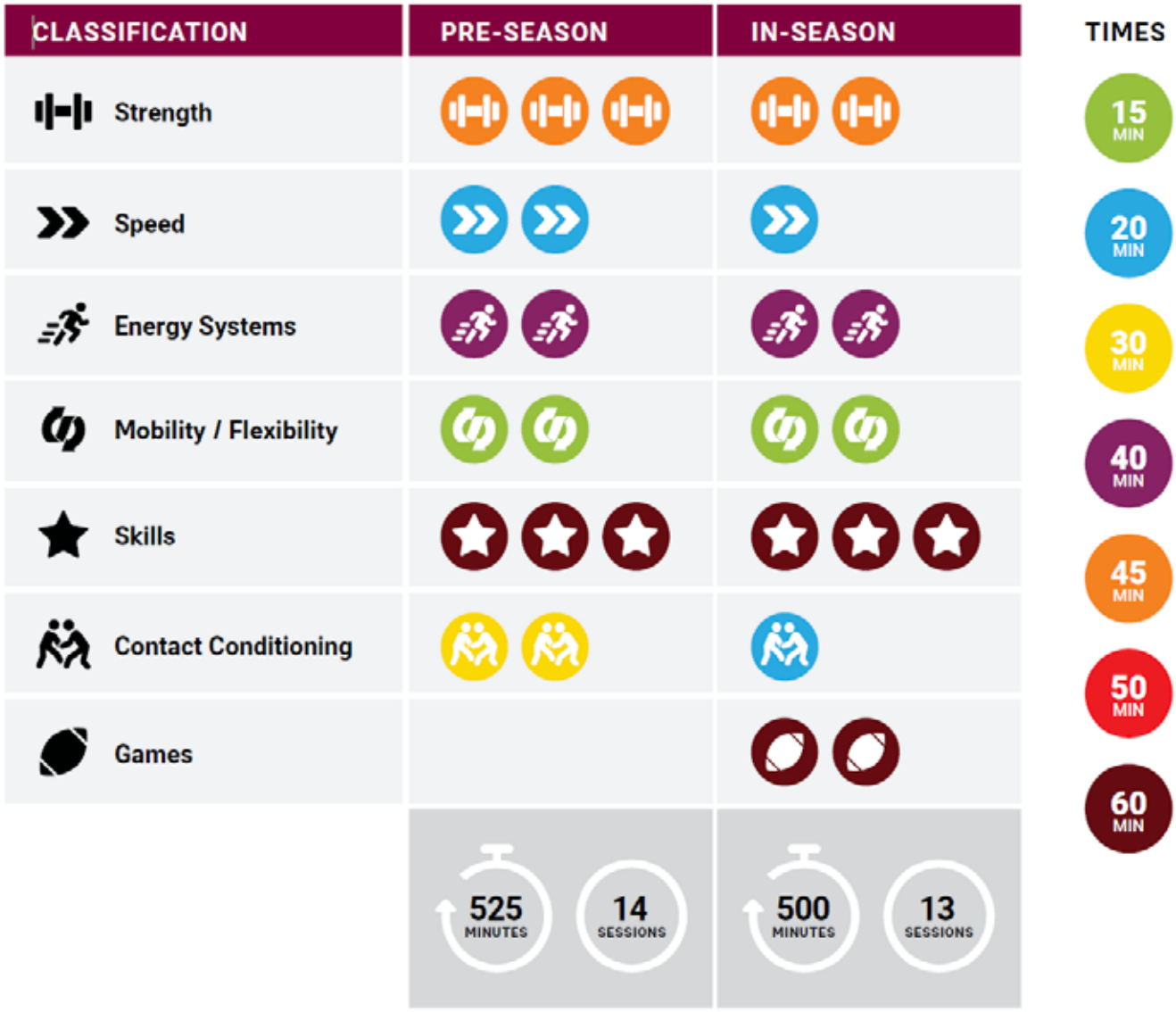
14-15 YEARS. FEMALE ATHLETES

(Image from QRL Physical Performance Framework)



16-17 YEARS. FEMALE ATHLETES

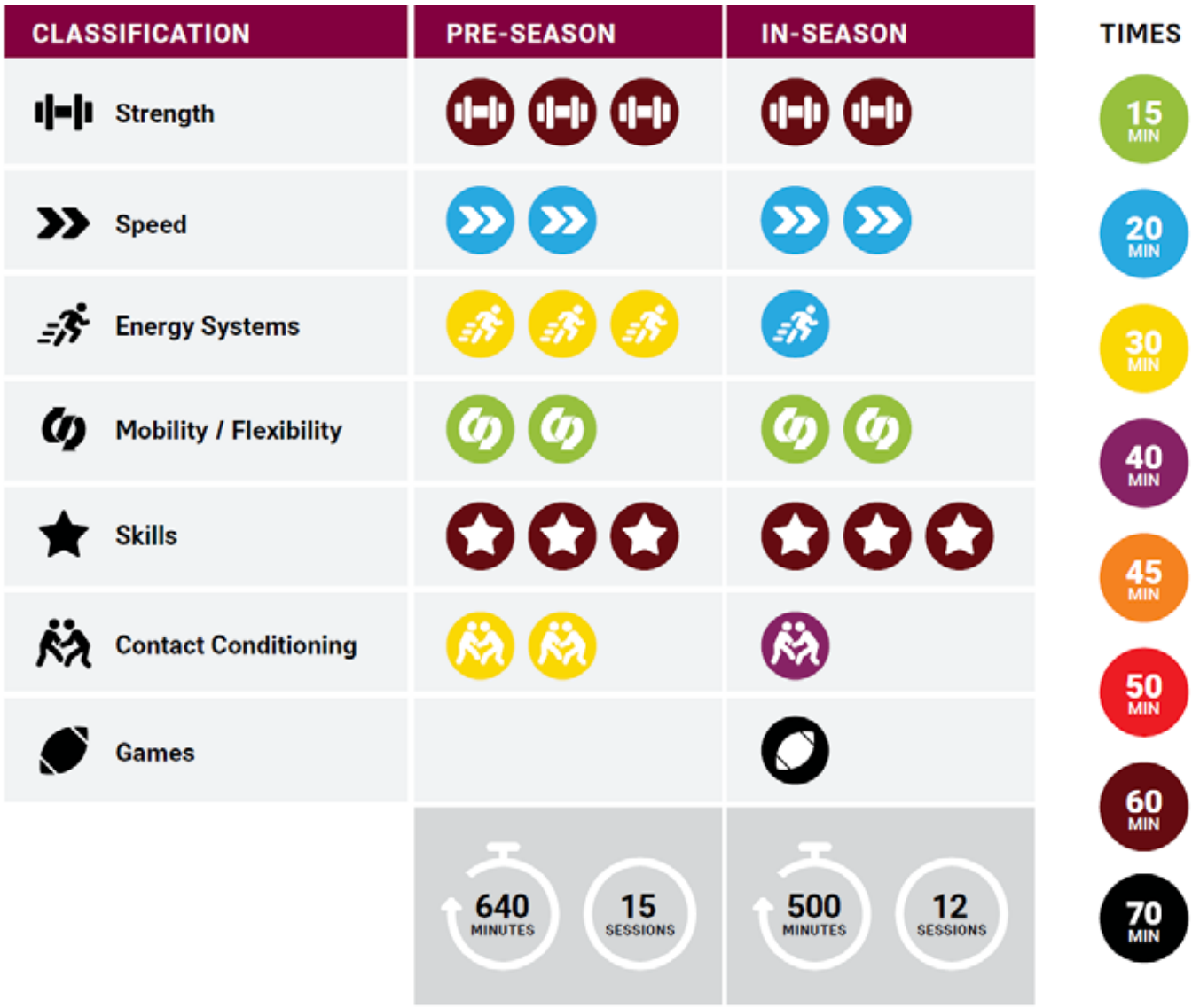
(Image from QRL Physical Performance Framework)



COACH MANUAL - SUGGESTED TRAINING EXPOSURES

18+ YEARS. FEMALE ATHLETES

(Image from QRL Physical Performance Framework)



Example: Neuromuscular Control Training session:

Each exercise in this session targets the specific anatomical and neuromuscular patterns that place female athletes at higher modifiable biomechanical risk. The greater Q-angle, lower tendon stiffness, tendency toward knee valgus under load, and delayed glute and hamstring activation before ground contact are all directly addressed in the exercise selection and the coaching cues.

Progression rule: An athlete must demonstrate controlled, stable technique at each phase before progressing to the next. Phase does not follow age or fitness. It follows movement quality.

Due to time constraints, focus on 3 to 4 of the exercises below each session. Rotate across the full list across the week so all nine movement targets are trained regularly.

#	Exercise	Why for female athletes	Performance Benefit	Coaching cue
1	Supine Heel Slide Walkouts	Activates distal hamstrings, which are underrecruited in female athletes who default to quad-dominant patterns.	Posterior chain activation, force production	Push your heel into the floor and slide slowly, do not let your hips drop.
2	Single-Leg Glute Bridge	Directly targets glute max and hamstrings, the primary hip stabilisers that protect the knee from valgus collapse.	Hip extension power, lumbopelvic control	Drive through the heel, squeeze the glute at the top, hips level.
3	Clamshell / Hip ER	Targets glute med and hip external rotators, which are chronically underactive in athletes with high Q-angle and knee valgus patterns.	Lateral chain stability, single-leg control	Keep your hips stacked, lift the top knee as high as you can without rolling your pelvis back. Imagine your foot is nailed to the floor.
4	Prone Hip Extension	Trains the hamstring-glute firing sequence that is often reversed in female athletes, where hamstrings fire late and glutes fire first.	Posterior chain recruitment efficiency	Squeeze the glute before you lift the leg, slow and controlled.
5	Standing Hip Abduction	Targets hip abductors that resist the inward knee pull caused by the wider female pelvis and greater Q-angle.	Cutting and landing control	Stand tall, do not lean, control the return, same speed both ways.
6	Single-Leg Balance	Develops proprioception and VMO activation, both of which are reduced in female athletes relative to male peers at the same training age.	Joint position sense, reactive stability	Soft knee, eyes forward, adjust without looking at your feet.
7	Lateral Band Walk	Loads glute med and VMO under tension, directly resisting the valgus force created by the Q-angle during lateral movement.	Deceleration, change-of-direction power	Push out against the band with every step, do not let the knees cave.
8	Low Box Step-Down	The highest-specificity exercise in this session. Trains eccentric knee control under load, the exact demand that is present in every landing and deceleration in the game.	Deceleration efficiency, landing mechanics	Lower slowly, knee tracks over second toe, touch the ground lightly and return.
9	Dead Bug	Builds deep trunk and lumbopelvic control that underpins every contact, landing, and force transfer in the game.	Force transfer, trunk stability under load	Lower limb moves, lower back stays flat on the floor, breathe out on the effort.

Key message for coaches: If you only have time for one part of this document in every session, this is it.

The exercises are simple, require minimal equipment, and directly address the movement patterns that drive higher modifiable biomechanical risk in female athletes.

Fifteen minutes done consistently across a season produces measurable changes in movement quality (Sugimoto et al., 2016; Myer et al., 2004).

COACH MANUAL

Example: Strength session

#	Exercise	Primary Target	Performance Benefit	Session Note
1	Squat (goblet or split squat)	Posterior chain Hip, knee joint complex	Gluteus maximus, quadriceps, hamstrings, adductors, soleus, erector spinae, core stabilisers	Warm up with goblet, progress to barbell or split squat.
2	Romanian Deadlift (dumbbell or barbell)	Posterior chain hip joint complex	Gluteus maximus, hamstrings, erector spinae, latissimus dorsi, trapezius, core stabilisers	Slow eccentric (3 sec down). Hip hinge focus.
3	Box step down, static knee, 45-degree lean	Posterior chain hip joint complex	Hip abductors, lateral rotators, gluteus medius and maximus, knee extensors and flexors, core stability, movement coordination and mobility	NON-NEGOTIABLE. Every session. Quality overload.
4	Seated Row (cable, band or machine)	Posterior chain hip joint complex	Rhomboids, middle and lower trapezius, latissimus dorsi, posterior deltoid, biceps brachii, erector spinae	Match or exceed push volume for shoulder health.
5	Push Press (dumbbell or barbell)	Vertical push, core stability, power	Deltoids, triceps brachii, upper trapezius, gluteus maximus, quadriceps, core stabilisers	Explosive drive from legs. Lower reps (3-5), higher intent.
6	Suitcase Carry (unilateral, dumbbell or kettlebell)	Lateral core stability, grip, loaded gait	Core stabilisers, quadratus lumborum, obliques, trapezius, forearm flexors, gluteus medius, erector spinae	Stand tall, do not lean. 20m each side. Finish the session with this.

Example: Conditioning Field Session — No Equipment Required

Set up a 50-metre area. Athletes perform continuous movement across all gait types: walk, jog, and sprint.

The coach controls all movement changes using a 3-2-1 verbal prompt followed by the movement command and duration. Example: “3-2-1 sprint (after 4 or 6 or 10 seconds), 3-2-1 drop and jog, (several seconds later) 3-2-1 sprint (5 seconds), 3-2-1 drop and walk.” Times vary according to athlete cardiovascular tolerance.

Tackle mimic: on the “drop” command, athletes lower themselves in a controlled manner to the ground and return to feet as fast as possible before transitioning into the next called movement.

(Could add a ball here for ball control and play of the ball complexity).

Structure: 3 to 4 bouts of 7 minutes with 2 minutes rest between bouts. The coach varies the ratio of walk, jog, sprint, and drop calls to manipulate intensity across the session.

Goal: repeated effort conditioning, mimicking the intermittent demands of field sport. Athletes should finish each bout at high effort but not unable to continue.

Example: Conditioning Field Session — Push pull sled relays

Set up cones at 0 metres, 10 metres, 20 metres and 30 metres. You need one sled per group of four athletes,
(use a 10kg plate for weight). Two athletes starting at each end (0m cone and 30m cone).

The single effort sequence for each athlete:

1. Start at the 0m cone. Push the sled 10 metres
2. Pull the sled back 10 metres to the start (0m cone)
3. Push the sled the full 30 metres to the opposite cone and hand off to the next athlete waiting there

The next athlete then completes the same sequence in reverse, finishing back at the 0m cone. Continue rotating until each athlete has completed 3 full efforts.

Coaching cues:

- Push: Drive the ground away underneath your hips, high knees, short fast steps, eyes up
- Pull: Stay low, lean back into the harness or rope, drive through the heels, do not round the lower back
- The transition between push and pull is where athletes lose time and form, cue them to reset their feet before they change direction

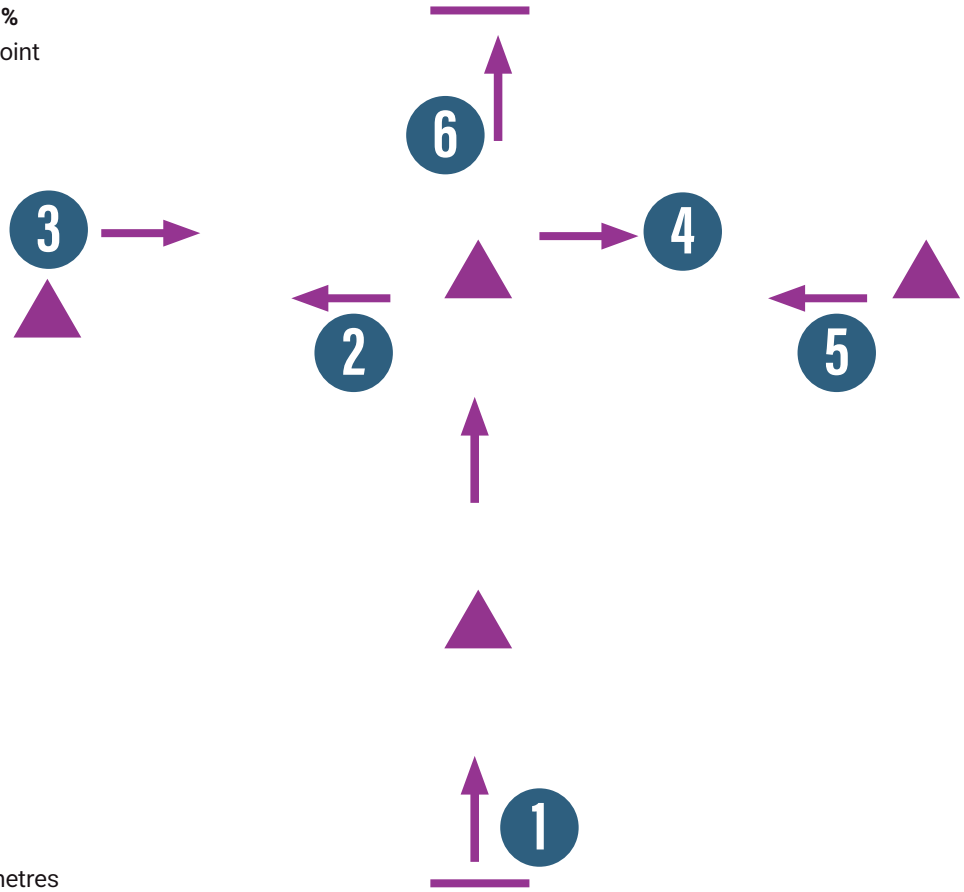
Integration with drills and skills:
This station runs simultaneously alongside your drills and skills session. Rotate four athletes out of drills and skills to the sled at a time. Once they have completed their 3 efforts each, they return fatigued to the drills and skills group and the next four rotate in.



Example: Cutting-Acceleration-Deceleration
(Assuming Sprint Mechanics Prerequisites are met)

Deceleration into acceleration is the core skill of every COD task and reflects the actual demands of the game. Once mechanics are sound, any field set-up can be used to train COD. Keep the decel-to-accel transition as the coaching focus regardless of the drill.

Field set up: I - T drill 50%, 75%, >75%
Athlete must touch the cone at each point (every time they pass any cone)



Six touches in one run through (Five metres between each cone)

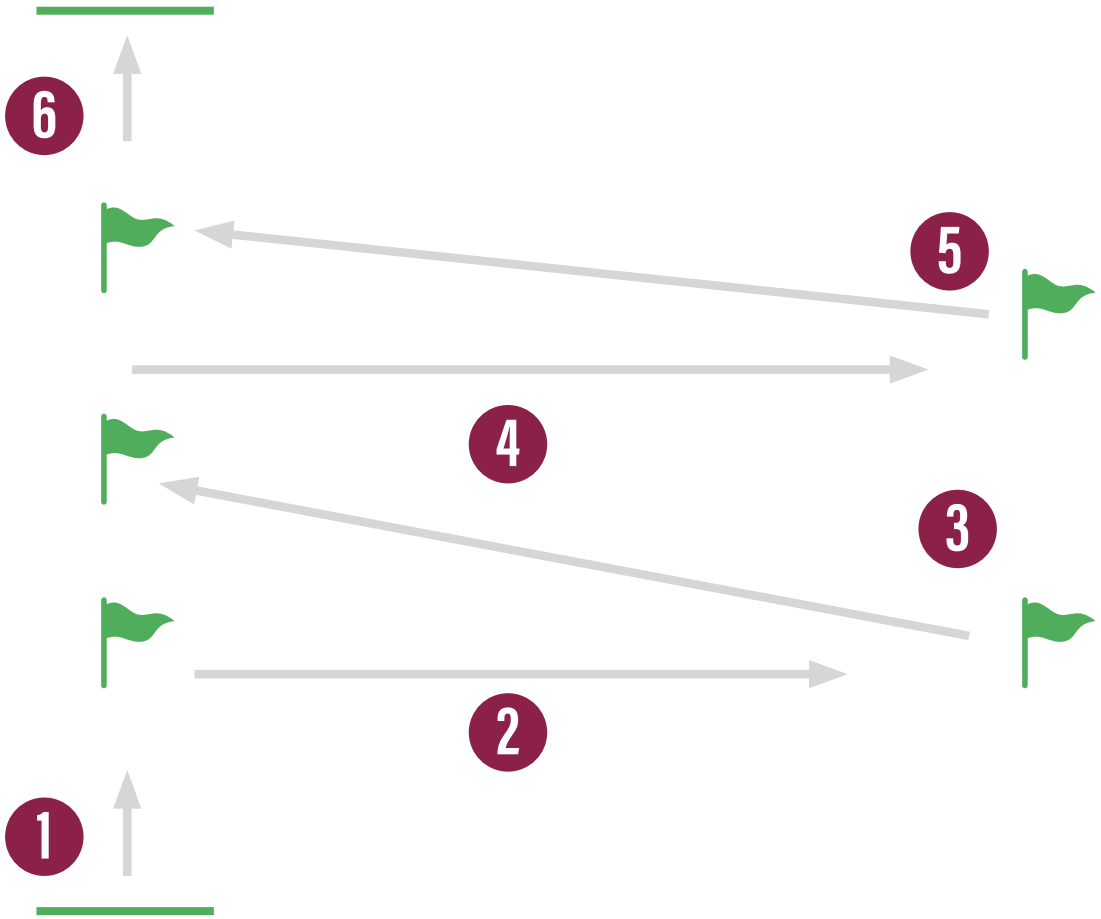
Movement pattern: All running is forward throughout. At each cone, the athlete does not sidestep or shuffle. Instead, she turns by planting her foot close to her base of support and rotating her hips through the direction change, so that she exits each cone still running forward in the new direction.

Deceleration cue: Drop the hips, take short, controlled braking steps into the cone, and plant the foot close to the body's centre of gravity rather than reaching out wide. A wide plant foot increases knee load. A foot planted close to the base reduces it and makes the turn faster.

Cutting cue: Keep the stepping foot close to the centre of gravity. This requires more, shorter steps into the turn rather than one large cut. The hip drives the direction change, not the foot. Shorter steps, hip rotation, and a foot close to the base become the default pattern under fatigue.

Why this matters for female athletes: A wide, single braking step at the cut point is the highest-risk movement pattern in female athletes during change of direction. It places peak valgus load on the knee at the moment of lowest muscular control. Forward running with a close foot plant and hip-driven rotation is both safer and faster out of the turn.

Example: Field set up: M drill



Movement pattern: All running is forward throughout. At each flag, the athlete does not sidestep or shuffle. She approaches each flag running forward, plants her foot close to her base of support, rotates her hips through the turn, and exits running forward in the new direction. The foot plant and hip rotation are the skill. The running is the expression of it.

Deceleration cue: Short, controlled braking steps into each flag. Drop the hips slightly as you approach. Do not reach the foot out wide to brake. The closer the plant foot is to the body, the less load on the knee and the faster the exit.

Cutting cue: Keep the stepping foot close to the centre of gravity. Drive the direction change from the hip, not the foot. Think hip first, foot follows. More shorter steps into the turn are always better than one large braking step. Once this becomes automatic at 50%, increase to 75% and then above 75% effort.

Progression: 50% effort first. Coaches must see controlled foot placement and hip rotation before increasing pace. Speed is earned by mechanics, not assigned by age or fitness level.

Why this matters for female athletes: The M drill trains repeated directional changes under forward momentum, which mirrors the actual demands of the game. The combination of greater Q-angle, lower tendon stiffness, and delayed glute activation means female athletes are at highest modifiable biomechanical risk precisely at the moment of the plant and turn. A hip-driven, close-foot-plant pattern directly reduces that load at every cone, every repetition, across the entire session.

PLAYER TRAINING STATUS ANALYSIS

STEP 1: READ THE ATHLETE

A simple tool for coaches to adjust training based on fatigue, cycle phase, or recovery status. Use this at the start of every session after the athlete check-in (this may be completed via an AMS platform such Teamworks AMS).

After the check-in conversation, assign a traffic light rating:

Green: Rested, motivated, no physical complaints, recovered from last session.

Amber: Some fatigue, mild soreness, low energy, cycle-related symptoms, mild stress or personal load.

Red: Significant fatigue, illness, injury concern, very high personal stress, heavy cycle symptoms, fewer than 6 hours sleep.

1. After every amber or red session, record all details.
2. A single amber day is normal. A pattern of amber or red across consecutive weeks is a flag that requires possible referral to professionals.
3. When in doubt: have the athlete do less. A missed session costs one session; a poorly managed athlete can cost a season.

If an athlete rates Red for psychological or emotional wellbeing, do not attempt to manage this alone. The following support lines are available for the athlete or for you to reference when needed.

Immediate free crisis support is available 24/7. For emergencies, call 000. For mental health, call 1300 MHCALL (1300 642 255). For general support, reach out to Lifeline at 13 11 14, Beyond Blue at 1300 22 4636 or White Cloud Foundation - Phone 07 3155 3456

STEP 2: MAKE THE CALL

Rating	Training Decision	NMC	Strength	Conditioning	Contact
Green	Full session as planned.	Full	Full	Full	Full
Amber	Modify volume or intensity. Shift to technical or skill work where needed.	Full	Reduced load	Reduced intensity	Limited or none
Red	Skip session or active recovery only. Refer if pattern persists.	Light only	None	None	None

STEP 3: EXAMPLES OF SPECIFIC SCENARIOS

Scenario 1: Athlete reports heavy menstrual symptoms (cramping, fatigue, pain)

Symptom Level	Action
Mild	Train as normal. Check in mid-session. Reduce intensity if symptoms worsen.
Moderate	Reduce volume and intensity. Shift to skill or technical work. Avoid heavy load and contact.
Severe	Excuse from session. Encourage rest, hydration, nutrition. Refer to GP if pattern persists.

Never dismiss menstrual symptoms as an excuse. Treat them with the same practical response you would give to any physical complaint.

Scenario 2: Athlete reports poor sleep (fewer than 6 hours)

Sleep Reported	Action
5 to 6 hours	Train, but modify high-intensity or contact components. Monitor through session.
Fewer than 5 hours	No contact, no maximum-load lifting, no high-intensity sprints. Skill and technical work only.
Consecutive poor nights	Refer to coach support or wellbeing officer. Investigate underlying cause (stress, environment, health).

Neuromuscular control and reaction time decline significantly with sleep debt. An under-slept athlete in a contact sport is a risk to herself and others.

Scenario 3: Athlete reports “I think, maybe I got a head knock during that game”

Or, concussion was reported and HIA carried out. Was observed athlete suffered head knock. Was observed athlete had contact to nose, cheek, mouth, head clash, landed on head, or head was forcefully rebounded from contact. Observed and reported by anyone, parents, friends, other athletes, or athlete turns up to training with a black eye.

Status	Action
No training	No training, no contact, no high-intensity work. Mandatory medical assessment before any return to activity.
Return to training	Only following clearance from the club doctor and following the graduated return-to-play protocol. Document each stage.

Scenario 4: Athlete returning from illness (cold, flu, gastrointestinal)

Days Since Symptoms	Action
Symptoms still present	No training. Rest, hydrate, recover.
1 day post symptoms	Light activity only: walking, mobility, very light skill work.
2-3 days post symptoms	Return to NMC and light strength. No contact, no high-intensity conditioning.
Full week post symptoms	Full return to training, graduated. Monitor for fatigue or relapse.

Scenario 5: Athlete reports a niggle or minor pain

Report	Action
Soreness only, no sharp pain	Train as normal. Monitor through session. Modify if pain develops.
Sharp or localised pain	Modify training to avoid aggravating movements. Refer to physiotherapist.
Joint swelling or instability	No training. Refer to physiotherapist or sports physician immediately.
Recurrent niggle in same location	Refer to physiotherapist. Investigate underlying cause and modify training plan.

Scenario 6: Athlete in luteal phase reporting fatigue or reduced coordination

Report	Action
Mild fatigue only	Train as normal. Ensure good nutrition and hydration. Monitor through session.
Fatigue plus reduced coordination	Reduce high-skill or high-precision work. Shift to aerobic base or simple strength. Avoid contact.
High heat conditions plus luteal phase	Adjust scheduling to cooler times. Increase hydration. Monitor closely for heat stress. Reduce intensity.

COACHING PRINCIPLES

11

Progressive Neuromuscular Control underpins all strength and conditioning.
Include 15 minutes of NMC activation, it is not to replace the warm-up.

The training session is the stimulus. Sleep is the session that counts.
Training tells the body what to adapt to. Sleep is when the adaptation happens. A hard session followed by poor sleep is a stimulus without a response. The work you do on the field is only as valuable as the recovery that follows it.

In the gym: build strength before load.
It does not have to be complicated, the NMC training attends to her anatomy. Strength training for female athletes should be built around compound movements, exercises that load multiple joints simultaneously, such as the squat, hinge, press, and row. These movements develop the posterior chain, trunk stability, and force production capacity that underpin every game demand. Master bodyweight and single-leg control before adding external weight. Once technique is sound, load progressively and do not underload. Female athletes adapt to heavy training. Trust the process and the program.

Velocity Based Training or Percentage Training: ensure it is consistent and regular throughout off-season, preseason, and competition season.

Teach deceleration before acceleration, teach landing before jumping.
Control before pace, always.

Understand that varying behaviours, motivation and tolerances will be cyclic due to hormones.
Every athlete's cycle experience is individual, keep the conversation going.

Food is not optional.
Under fuelling is a risk, watch for signs of RED-S.

Your relationship with her matters. Her relationships within the team are critical.
An athlete who trusts her coach will tell you she is not coping before it becomes a crisis. An athlete who belongs to her team will push through adversity rather than disengage. Build connection deliberately, it is part of the program (Kernan et al., 2025; Stevens et al., 2024).



REFERENCES

Abrahamson, J., Sandstedt, E., Sansone, M., & Lindman, I. (2025). Female sex, training volume and sleep amount are risk factors for sports-related injuries: A 1-year prospective cohort study on adolescent elite athletes. BMJ Open Sport & Exercise Medicine, 11(4), Article e002699. https://doi.org/10.1136/bmjsem-2025-002699

Acheson, J., Joanisse, S., Sale, C., & Hodson, N. (2025). Recycle, repair, recover: The role of autophagy in modulating skeletal muscle repair and post-exercise recovery. Bioscience Reports, 45(1), 1–30. https://doi.org/10.1042/BSR20240137

Behm, D. G., Blazevich, A. J., Kay, A. D., & McHugh, M. (2016). Acute effects of muscle stretching on physical performance, range of motion, and injury incidence in healthy active individuals: A systematic review. Applied Physiology, Nutrition, and Metabolism, 41(1), 1–11. https://doi.org/10.1139/apnm-2015-0235

Call, J. A., & Nichenko, A. S. (2020). Autophagy: An essential but limited cellular process for timely skeletal muscle recovery from injury. Autophagy, 16(7), 1344–1347. https://doi.org/10.1080/15548627.2020.1753000

Charest, J., & Grandner, M. A. (2020). Sleep and athletic performance: Impacts on physical performance, mental performance, injury risk and recovery, and mental health. Sleep Medicine Clinics, 15(1), 41–57. https://doi.org/10.1016/j.jsmc.2019.11.005

Costa, J., Figueiredo, P., Nakamura, F. Y., & Brito, J. (2022). The importance of sleep in athletes. In Exercise physiology. IntechOpen. https://www.intechopen.com/chapters/80371

Dabbs, N. C., Binkley, H., Bott, C., Fragala, M. S., Herda, A., Moeskops, S., Moore, E. W. G., Smith-Ryan, A. E., & Triplett, N. T. (2026a). National Strength and Conditioning Association position statement on strength and conditioning of female athletes. Part I: Lifespan, injury, and health considerations. Journal of Strength and Conditioning Research, 40(8), 875–894. https://doi.org/10.1519/JSC.0000000000005544

Dabbs, N. C., Binkley, H., Bott, C., Fragala, M. S., Herda, A., Moeskops, S., Moore, E. W. G., Smith-Ryan, A. E., & Triplett, N. T. (2026b). National Strength and Conditioning Association position statement on strength and conditioning of female athletes. Part II: Training adaptations and program design. Journal of Strength and Conditioning Research, 40(8), 895–908. https://doi.org/10.1519/JSC.0000000000005493

Dezman, Z. D. W., Ledet, E. H., & Kerr, H. A. (2013). Neck strength imbalance correlates with increased head acceleration in soccer heading. Sports Health, 5(4), 320–326. https://doi.org/10.1177/1941738113480935

Diekelmann, S., & Born, J. (2010). The memory function of sleep. Nature Reviews Neuroscience, 11(2), 114–126. https://doi.org/10.1038/nrn2762

Donelon, T. A., Edwards, J., Brown, M., Jones, P. A., O'Driscoll, J., & Dos'Santos, T. (2024). Differences in biomechanical determinants of ACL injury risk in change of direction tasks between males and females: A systematic review and meta-analysis. Sports Medicine - Open, 10, Article 29. https://doi.org/10.1186/s40798-024-00701-z

Dos'Santos, T., Stebbings, G. K., Morse, C., Shashidharan, M., Daniels, K. A. J., & Sanderson, A. (2023). Effects of the menstrual cycle phase on anterior cruciate ligament neuromuscular and biomechanical injury risk surrogates in eumenorrheic and naturally menstruating women: A systematic review. PLOS ONE, 18(1), Article e0280800. https://doi.org/10.1371/journal.pone.0280800

Evans, A. L., Coffee, P., & Barker, J. B. (2023). The effects of social identity and social identity content on cohesion, efficacy, and performance across a competitive rugby league season. International Journal of Sport and Exercise Psychology, 22(7), 1724–1742. https://doi.org/10.1080/1612197X.2023.2229349

Frost, H. M. (1994). Wolff's law and bone's structural adaptations to mechanical usage: An overview for clinicians. The Angle Orthodontist, 64(3), 175–188. https://doi.org/10.1043/0003-3219(1994)064<0175:WLABSA>2.0.CO;2

Gabbett, T. J. (2005). Science of rugby league football: A review. Journal of Sports Sciences, 23(9), 961–976. https://doi.org/10.1080/02640410400023381

Galletti, B. A. R., Chesbro, G. A., & Larson, R. D. (2025). No differences in lactate threshold across the menstrual cycle in untrained females. International Journal of Exercise Science, 18(8), 193–205. https://doi.org/10.70252/JKXM8836

Gant, H., Ghimire, N., Min, K., Musa, I., Ashraf, M., & Lawan, A. (2024). Impact of the quadriceps angle on health and injury risk in female athletes. International Journal of Environmental Research and Public Health, 21(12), Article 1547. https://doi.org/10.3390/ijerph21121547

Grier, L. A., Meyer, A. J., & Leicht, A. (2026). Athletic movement competency of semi-elite, adolescent, female, rugby league athletes. International Journal of Sports Science & Coaching. Advance online publication. https://doi.org/10.1177/17479541261444457

Hackney, A. C., McCracken-Compton, M. A., & Ainsworth, B. (1994). Substrate responses to submaximal exercise in the midfollicular and midluteal phases of the menstrual cycle. International Journal of Sport Nutrition, 4(3), 299–308. https://doi.org/10.1123/ijsn.4.3.299

Haizlip, K. M., Harrison, B. C., & Leinwand, L. A. (2015). Sex-based differences in skeletal muscle kinetics and fiber-type composition. Physiology, 30(1), 30–39. https://doi.org/10.1152/physiol.00024.2014

Haraldsdottir, K., Sanfilippo, J., McKay, L., & Watson, A. M. (2021). Decreased sleep and subjective well-being as independent predictors of injury in female collegiate volleyball players. Orthopaedic Journal of Sports Medicine, 9(9), Article 23259671211029285. https://doi.org/10.1177/23259671211029285

Harms, C. A. (2006). Does gender affect pulmonary function and exercise capacity? Respiratory Physiology & Neurobiology, 151(2–3), 124–131. https://doi.org/10.1016/j.resp.2005.10.010

Herzberg, S. D., Motu'apuaka, M. L., Lambert, W., Fu, R., Brady, J., & Guise, J.-M. (2017). The effect of menstrual cycle and

contraceptives on ACL injuries and laxity: A systematic review and meta-analysis. Orthopaedic Journal of Sports Medicine, 5(7), Article 2325967117718781. https://doi.org/10.1177/2325967117718781
Hewett, T. E., Myer, G. D., & Ford, K. R. (2006). Anterior cruciate ligament injuries in female athletes: Part 1, mechanisms and risk factors. The American Journal of Sports Medicine, 34(2), 299–311. https://doi.org/10.1177/0363546505284183
Hewett, T. E., Zazulak, B. T., & Myer, G. D. (2007). Effects of the menstrual cycle on anterior cruciate ligament injury risk: A systematic review. The American Journal of Sports Medicine, 35(4), 659–668. https://doi.org/10.1177/0363546506295699
Holdsworth, D. A., O'Leary, T. J., Doig, C. L., Taylor, N., Dosanjh, J., Woods, D. R., Stacey, M. J., & Gifford, R. M. (2026). Physiological basis of sex differences in human performance and exercise-associated pathology. Clinical Endocrinology, 105(2), 151–162. https://doi.org/10.1111/cen.70150
Hutchins, K. P., Minett, G. M., & Stewart, I. B. (2022). Treating exertional heat stroke: Limited understanding of the female response to cold water immersion. Frontiers in Physiology, 13, Article 1055810. https://doi.org/10.3389/fphys.2022.1055810
Johnston, R. D., Gabbett, T. J., & Jenkins, D. G. (2014). Applied sport science of rugby league. Sports Medicine, 44(8), 1087–1100. https://doi.org/10.1007/s40279-014-0190-x
Jones, P. A., Thomas, C., Dos'Santos, T., McMahon, J. J., & Graham-Smith, P. (2017). The role of eccentric strength in 180° turns in female soccer players. Sports, 5(2), Article 42. https://doi.org/10.3390/sports5020042
Kernan, A. R., Cope, M. R., Jarvis, J. A., & Dufur, M. J. (2025). Coach–athlete relationships and mental health: An exploratory study on former female NCAA student-athletes. International Journal of Environmental Research and Public Health, 22(11), Article 1652. https://doi.org/10.3390/ijerph22111652
King, D. A., Hume, P. A., Milburn, P. D., & Guttenbeil, D. (2010). Match and training injuries in rugby league: A review of published studies. Sports Medicine, 40(2), 163–178. https://doi.org/10.2165/11319740-000000000-00000
Lamon, S., Morabito, A., Arentson-Lantz, E., Knowles, O., Vincent, G. E., Condo, D., Alexander, S. E., Garnham, A., Paddon-Jones, D., & Aisbett, B. (2021). The effect of acute sleep deprivation on skeletal muscle protein synthesis and the hormonal environment. Physiological Reports, 9(1), Article e14660. https://doi.org/10.14814/phy2.14660
Laursen, P. B., & Jenkins, D. G. (2002). The scientific basis for high-intensity interval training. Sports Medicine, 32(1), 53–73. https://doi.org/10.2165/00007256-200232010-00003
Lewis, L. D. (2021). The interconnected causes and consequences of sleep in the brain. Science, 374(6567), 564–568. https://doi.org/10.1126/science.abi8375
Leyk, D., Gorges, W., Ridder, D., Wunderlich, M., Rüther, T., Sievert, A., & Essfeld, D. (2007). Hand-grip strength of young men, women and highly trained female athletes. European Journal of Applied Physiology, 99(4), 415–421. https://doi.org/10.1007/s00421-006-0351-1
Mason, L., Connolly, J., Devenney, L. E., Lacey, K., O'Donovan, J., & Doherty, R. (2023). Sleep, nutrition, and injury risk in adolescent athletes: A narrative review. Nutrients, 15(24), Article 5101. https://doi.org/10.3390/nu15245101
McNulty, K. L., Elliott-Sale, K. J., Dolan, E., Swinton, P. A., Ansdell, P., Goodall, S., Thomas, K., & Hicks, K. M. (2020). The effects of menstrual cycle phase on exercise performance in eumenorrheic women: A systematic review and meta-analysis. Sports Medicine, 50(10), 1813–1827. https://doi.org/10.1007/s40279-020-01319-3
Milewski, M. D., Skaggs, D. L., Bishop, G. A., Pace, J. L., Ibrahim, D. A., Wren, T. A. L., & Barzdukas, A. (2014). Chronic lack of sleep is associated with increased sports injuries in adolescent athletes. Journal of Pediatric Orthopaedics, 34(2), 129–133. https://doi.org/10.1097/BPO.0000000000000151
Moriceau, J., Fevre, A., Domínguez-Balmaseda, D., González-de-la-Flor, Á., Simón-Areces, J., & García-Pérez-de-Sevilla, G. (2022). The influence of the menstrual cycle and oral contraceptives on knee laxity or anterior cruciate ligament injury risk: A systematic review. Applied Sciences, 12(24), Article 12627. https://doi.org/10.3390/app122412627
Mountjoy, M., Sundgot-Borgen, J. K., Burke, L. M., Ackerman, K. E., Blauwet, C., Constantini, N., Lebrun, C., Lundy, B., Melin, A. K., Meyer, N. L., Sherman, R. T., Tenforde, A. S., Torstveit, M. K., & Budgett, R. (2023). 2023 International Olympic Committee's (IOC) consensus statement on Relative Energy Deficiency in Sport (REDs). British Journal of Sports Medicine, 57(17), 1073–1098. https://doi.org/10.1136/bjsports-2023-106994
Munteanu, G., Halson, S. L., Huynh, M., Jukic, I., García-Ramos, A., Fernandez, F., Cowley, N., & Weakley, J. (2026). The effect of menstrual cycle phase, symptoms, motivation, and readiness to perform on resistance training performance. Sports Medicine, 56(9), 2325–2339. https://doi.org/10.1007/s40279-026-02459-8
Myer, G. D., Ford, K. R., Brent, J. L., & Hewett, T. E. (2006). The effects of plyometric vs. dynamic stabilization and balance training on power, balance, and landing force in female athletes. Journal of Strength and Conditioning Research, 20(2), 345–353. https://doi.org/10.1519/R-17955.1
Myer, G. D., Ford, K. R., & Hewett, T. E. (2004). Rationale and clinical techniques for anterior cruciate ligament injury prevention among female athletes. Journal of Athletic Training, 39(4), 352–364.
Nicolay, R. W., Hartwell, M. J., Bigach, S., Fernandez, C., Morgan, A. M., Cogan, C., Terry, M., & Tjong, V. K. (2023). The sport-specific prevalence of generalized joint hypermobility in collegiate athletes: A cross-sectional study [ePoster]. ISAKOS Congress. https://www.isakos.com/GlobalLink/Abstract/5001
Nimphius, S., Callaghan, S. J., Spiteri, T., & Lockie, R. G. (2016). Change of direction deficit: A more isolated measure of change of direction performance than total 505 time. Journal of Strength and Conditioning Research, 30(11), 3024–3032. https://doi.org/10.1519/JSC.0000000000001421

REFERENCES

Nimphius, S., & Kadlec, D. (2026). Warm-up is not a workout: A principles-based critique of continued efforts to use warm-up programmes for ACL injury prevention. British Journal of Sports Medicine. Advance online publication. https://doi.org/10.1136/bjsports-2025-110614

Nuzzo, J. L. (2024). Sex differences in skeletal muscle fiber types: A meta-analysis. Clinical Anatomy, 37(1), 81–91. https://doi.org/10.1002/ca.24091

Pensgaard, A. M., Ivarsson, A., Nilstad, A., Solstad, B. E., & Steffen, K. (2018). Psychosocial stress factors, including the relationship with the coach, and their influence on acute and overuse injury risk in elite female football players. BMJ Open Sport & Exercise Medicine, 4(1), Article e000317. https://doi.org/10.1136/bmjsem-2017-000317

Ramachandran, A. K., Pedley, J. S., Moeskops, S., Oliver, J. L., Myer, G. D., & Lloyd, R. S. (2024). Changes in lower limb biomechanics across various stages of maturation and implications for ACL injury risk in female athletes: A systematic review. Sports Medicine, 54(7), 1851–1876. https://doi.org/10.1007/s40279-024-02022-3

Sawka, M. N., Burke, L. M., Eichner, E. R., Maughan, R. J., Montain, S. J., & Stachenfeld, N. S. (2007). American College of Sports Medicine position stand: Exercise and fluid replacement. Medicine & Science in Sports & Exercise, 39(2), 377–390. https://doi.org/10.1249/mss.0b013e31802ca597

Seagrave, L., Mouchbahani, R., & O'Donnell, K. (2009). Neuro-biomechanics of maximum velocity sprinting. New Studies in Athletics, 24(1), 19–27.

Simic, L., Sarabon, N., & Markovic, G. (2013). Does pre-exercise static stretching inhibit maximal muscular performance? A meta-analytical review. Scandinavian Journal of Medicine & Science in Sports, 23(2), 131–148. https://doi.org/10.1111/j.1600-0838.2012.01444.x

Stevens, M., Cruwys, T., Olive, L., & Rice, S. (2024). Understanding and improving athlete mental health: A social identity approach. Sports Medicine, 54(4), 837–853. https://doi.org/10.1007/s40279-024-01996-4

Stich, F. M., Huwiler, S., D'Hulst, G., & Lustenberger, C. (2022). The potential role of sleep in promoting a healthy body composition: Underlying mechanisms determining muscle, fat, and bone mass and their association with sleep. Neuroendocrinology, 112(7), 673–701. https://doi.org/10.1159/000518691

Suchomel, T. J., Nimphius, S., & Stone, M. H. (2016). The importance of muscular strength in athletic performance. Sports Medicine, 46(10), 1419–1449. https://doi.org/10.1007/s40279-016-0486-0

Sugimoto, D., Myer, G. D., Barber Foss, K. D., Pepin, M. J., Micheli, L. J., & Hewett, T. E. (2016). Critical components of neuromuscular training to reduce ACL injury risk in female athletes: Meta-regression analysis. British Journal of Sports Medicine, 50(20), 1259–1266. https://doi.org/10.1136/bjsports-2015-095596

Sunderland, C., & Nevill, M. E. (2003). Effect of the menstrual cycle on performance of intermittent, high-intensity shuttle running in a hot environment. European Journal of Applied Physiology, 88(4–5), 345–352. https://doi.org/10.1007/s00421-002-0722-1

Versey, N. G., Halson, S. L., & Dawson, B. T. (2013). Water immersion recovery for athletes: Effect on exercise performance and practical recommendations. Sports Medicine, 43(11), 1101–1130. https://doi.org/10.1007/s40279-013-0063-8

Wafford, K. A. (2021). Aberrant waste disposal in neurodegeneration: Why improved sleep could be the solution. Cerebral Circulation - Cognition and Behavior, 2, Article 100025. https://doi.org/10.1016/j.cccb.2021.100025

Wang, Y., Qiu, J., Dai, D., Li, Q., Wang, X., & Luo, Q. (2026). The effects of velocity-based vs. percentage-based resistance training on sports performance in trained individuals: A systematic review and meta-analysis. BMC Sports Science, Medicine and Rehabilitation, 18(1), Article 57. https://doi.org/10.1186/s13102-025-01504-9

Wellauer, V., Clijsen, R., Bianchi, G., Riggi, E., & Hohenauer, E. (2025). No acceleration of recovery from exercise-induced muscle damage after cold or hot water immersion in women: A randomised controlled trial. PLOS ONE, 20(5), Article e0322416. https://doi.org/10.1371/journal.pone.0322416

Wheatley, C. M., Snyder, E. M., Johnson, B. D., & Olson, T. P. (2014). Sex differences in cardiovascular function during submaximal exercise in humans. SpringerPlus, 3, Article 445. https://doi.org/10.1186/2193-1801-3-445

Xie, L., Kang, H., Xu, Q., Chen, M. J., Liao, Y., Thiyagarajan, M., O'Donnell, J., Christensen, D. J., Nicholson, C., Iliff, J. J., Takano, T., Deane, R., & Nedergaard, M. (2013). Sleep drives metabolite clearance from the adult brain. Science, 342(6156), 373–377. https://doi.org/10.1126/science.1241224

Yang, D. F., Shen, Y. L., Wu, C., Huang, Y. S., Lee, P. Y., Er, N. X., Huang, W. C., & Tung, Y. T. (2019). Sleep deprivation reduces the recovery of muscle injury induced by high-intensity exercise in a mouse model. Life Sciences, 235, Article 116835. https://doi.org/10.1016/j.lfs.2019.116835

Zech, A., Hollander, K., Junge, A., Steib, S., Groll, A., Heiner, J., Nowak, F., Pfeiffer, D., & Rahlf, A. L. (2022). Sex differences in injury rates in team-sport athletes: A systematic review and meta-regression analysis. Journal of Sport and Health Science, 11(1), 104–114. https://doi.org/10.1016/j.jshs.2021.04.003

Zhang, M., Liang, X., Huang, W., Ding, S., Li, G., Zhang, W., Li, C., Zhou, Y., Sun, J., & Li, D. (2023). The effects of velocity-based versus percentage-based resistance training on athletic performances in sport-collegiate female basketball players. Frontiers in Physiology, 13, Article 992655. https://doi.org/10.3389/fphys.2022.992655

Zouita, A., Darragi, M., Bousselmi, M., Sghaeir, Z., Clark, C. C. T., Hackney, A. C., Granacher, U., & Zouhal, H. (2023). The effects of resistance training on muscular fitness, muscle morphology, and body composition in elite female athletes: A systematic review. Sports Medicine, 53(9), 1709–1735. https://doi.org/10.1007/s40279-023-01859-4


rebel
Harvey Norman

THE QRL FEMALE ATHLETE FRAMEWORK

TRAINING, RECOVERY AND PERFORMANCE FOR RUGBY LEAGUE COACHES