Considerations for coaches training female athletes

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OVERVIEW

Like their male counterparts, female athletes want to become fitter, faster and stronger, meaning that there is a requirement for researchers, practitioners and coaches to better understand the female athlete. Most training programmes/interventions are based upon research on men: women have been considered physiologically too variable, with the menstrual cycle deemed to be a barrier for inclusion with potential interference to results. There are many physiological and psychological differences between the sexes, and indeed between women themselves (eg, oral contraceptive users versus non-users). Therefore, in order to truly individualise and optimise training, these differences must be considered during the planning and implementation of strength and conditioning plans. Coaches need to understand female-specific issues such as: the menstrual cycle, breast health, female psychology and trends in female injuries in order to be able truly to promote the health and well-being of female athletes, this means, in turn, that they can train sportswomen in their own right and not group them with men.

Introduction

There is a rapidly growing need to better understand the modern female athlete, with the Women’s Super League and Championship having now gone full- and part-time – as well as women’s rugby union and cricket also gaining full-time status. As the level of female sporting performance and professionalism increases, so too must our understanding of how to optimise a female’s athletic performance. Strength and conditioning (S&C) coaches working with young athletes often say ‘children are not mini adults’, thus highlighting the anatomical and physiological differences between adults and children, and the need to tailor training programmes accordingly. With this in mind, should female athletes be trained in the same manner as male athletes, given that there are anatomical, physiological and endocrine differences between the sexes? Female athletes are not smaller male athletes and this should be considered as one of the key training considerations.

From a performance perspective it is clear that men and women differ in muscle mass and strength, anaerobic power and capacity, muscle cross sectional area, maximal aerobic capacity and performance. A female’s absolute whole-body strength (1RM), upper body strength and lower limb strength is 60-63.5%, 55% and 72% respectively of a man’s. However, when absolute values are compared relative to body weight, fat-mass and muscle cross sectional area, a woman’s lower body strength is similar to that of a man’s; the upper body strength of a woman, though, is still somewhat less.
Research data show that muscle hypertrophy is similar between sexes, as are muscle synthesis rates post exercise and rate of gain of CSA per day. Strength training programmes for females should be based on the same principles as males – namely multi-muscle, multi-joint and high intensity movements and exercises – as females respond to strength training in the same way that men do. Previous data suggest that training experiences, access to specialised training and the fact that female athletes enter sport less conditioned, all account for initial sex differences in strength. These strength differences are eliminated when appropriate training is undertaken. Triplett and Stone concluded that resistance training is the primary determinant of muscle mass and its distribution around the body.

Menstrual cycle

Menstruation occurs when the endometrium wall is sloughed off and discharged. This happens around 9-10 times a year (approximately every 24–35 days) and on average ~457 times, until the menopause (cessation of menstrual cycle) occurs. In the US, the average age for menarche (the onset of the menstrual cycle) is 12.7 ± 1.3 years; however, it is important to note that, as the hypothalamic–pituitary–gonadal axis is yet to be fully established from its pre-pubertal state, cycles are often anovulatory (ie, no egg matures) and irregular for several years. The menstrual cycle comprises of three phases: menses (or menstruation), follicular and luteal. The cycle contains varying amounts of two endogenous hormones: oestrogen which is low during the menses, high during the follicular phase and moderate during the luteal phase; and progesterone, which is low during menses and follicular phase, but high during luteal phase (see Figure 1).

During menstruation (also known as a period), blood and tissue is discharged for between 2-7 days; the shedding of the endometrial wall is important as it removes any unfertilised eggs. Typically, the blood and tissue discharged is not significant enough in volume to affect exercise performance.

Within the follicular phase, the uterine lining is reconstructed under the influence of oestrogen; during this time an egg will slowly mature until ovulation, which subsequently starts the luteal phase. In this final stage, progesterone will prepare the endometrium for implantation: however, if no egg is fertilised, oestrogen and progesterone decline sharply and a new cycle begins.

The follicular phase has been associated with an increase in endurance, insulin sensitivity and pain tolerance. Julian et al showed that performance of the Yo-Yo test was considerably higher in the early follicular phase (3,288 ± 800m), compared to the mid luteal phase (2,833 ± 696m); a trend towards significance was observed (p = 0.07), but other research has shown that hormonal changes during the menstrual cycle do not influence anaerobic performance. Sung et al investigated the effects of strength training in 20 untrained eumenorrheic women (women with normal periods) over

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**Figure 1. Example of a 28-day menstrual cycle**

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three consecutive cycles. Subjects completed four training sessions a week, where one leg was mainly trained in the follicular phase and the other in the luteal phase. Their results demonstrated that the leg trained in the follicular phase was significantly larger in absolute maximal isometric force compared to the luteal dominant leg (188 ± 98 vs 267 ± 101N). Furthermore, follicular phase strength training saw a significant increase in muscle diameter and type II muscle fibre diameter. Another study showed that handgrip was highest in the follicular phase when oestrogen concentrations were high and progesterone concentrations were low. However, research exists which contradicts these findings. Elliott et al assessed isometric strength in seven eumenorrheic females in the early follicular and mid-luteal phase: the results indicated that cyclical variation in endogenous reproductive hormones did not affect muscle strength. Currently, findings are not consistent enough to draw clear conclusions about the effects of the menstrual cycle phase on aerobic and anaerobic performance.

There is still some confusion regarding the menstrual cycle and performance; famous cases include Paula Radcliffe, who set a world record during her period, and England Lionesses midfielder Jordan Nobbs, who suffered from premenstrual symptoms prior to her injury. Many limitations occur within research as poor methodologies, self-reporting of menstrual cycle, low sample sizes and inter- and intra-variability of menstrual cycles all leave more questions than answers. Historically, it was believed that women should avoid exercise to maintain fertility and that exercise was too ‘stressful’ for women; menstrual disturbances were noted following running up to 10 miles a day in untrained women.

The menstrual cycle is often seen as a taboo in female athletes; a naïve S&C coach may be unwilling to consider the potential impacts that a eumenorrheic menstrual cycle could have on physical performance and wellness. The menstrual cycle is important for sexual function, fertility, bone health, cognitive function and mood. The impact of menstrual dysfunction (amenorrhea, anovulation, luteal phase defect, and oligomenorrhoea), which is seen in roughly 50% of exercising adults and 54% of female adolescent athletes who regularly participate in sport, is often overlooked. It is important to emphasise that abnormalities in a female’s menstrual cycle should not be assumed to be associated with exercise until psychological and/or physiological causes are ruled out.

Further research on how the ovarian hormones affect sporting performance is required if coaches are to provide the best training stimulus to achieve optimal adaptation. It is likely that recording and tracking a player’s cycle will have a positive impact on performance and start the all-important conversations on menstrual health.

**Female Athlete Triad and Relative Energy Deficiency in Sport**

The single biggest challenge for athletes, especially female athletes, is to avoid low energy availability due to its known effects on menstrual function and bone health – as evidenced by the Female Athlete Triad (which describes the synergist relationship between energy availability, menstrual function and bone health). Relative Energy Deficiency in Sport (RED-S) is a condition caused by low energy availability, which impairs many bodily processes, such as menstrual function, musculoskeletal health, gastrointestinal function, cardiovascular function and growth and development. As a result of these changes to physical functioning, many aspects of sports performance may also be negatively affected. Likewise, there may be psychological effects that either cause RED-S or are the result of RED-S. The International Olympic Committee (IOC) created this broader and more comprehensive syndrome in 2014, to supersede the previous term – ie, the Female Athlete Triad – for the condition. RED-S can affect the physical functioning, health and performance of not just females, but also males, non-Caucasians and athletes with a disability. At present, some, but not all, of the proposed effects of RED-S have limited evidence to support them, as the RED-S model is in its early stages of development. Bone and reproductive health are the most evidence-based systems in this model, given their established history as part of the Female Athlete Triad, which was first recognised as a disorder in the 1990s. In addition, evidence on the endocrine changes resulting from RED-S is emerging. The original RED-S consensus paper was published in 2014 and since then there have been several updates and additions.

Moutjoy et al proposed a set of criteria for assessing RED-S and guiding athletes and coaches regarding return to play following RED-S. Female athletes, unlike males, have
a unique early warning detection system for low energy availability as menstrual function is one of the first physiological systems to be sacrificed when energy availability is restricted. As such, it is vitally important to monitor menstrual function in female athletes.

### Hormonal contraceptives

Although menstrual cycle hormones are endogenous (naturally occurring within the body), oral contraceptives provide exogenous (external synthetic) oestrogens and progestins. These exogenous hormones downregulate endogenous oestrogen and progesterone due to negative feedback on the hypothalamic-pituitary ovarian axis (see Figure 2 for a comparison of the two). Currently, there is a wide range of hormonal contraceptives available, including oral contraceptives (combined, progestin-only), injections, implants, vaginal rings, patches and intra-uterine systems. Oral contraceptive use is high in the general population and in athletes, with 49.5% of athletes based within the UK currently using some type of hormonal contraceptive and 69.8% having used a hormonal contraceptive at some point in their career.

The menstrual cycle is usually standardised to a 28-day cycle, and oral contraceptives are designed to mimic that same cycle length. Typically, individuals are required to take one pill a day for 21 days, followed by seven consecutive placebo pills or pill-free days. During the seven pill-free days of a combined monophasic oral contraceptive regimen, women often experience a withdrawal bleed, which should not be confused with a period, as these are not the same thing.

Oral contraceptive use has been shown to have positive and negative symptoms in athletes: Martin et al showed benefits, such as improved skin, reduced bleeding and reduced period pain, and negative effects such as weight gain and irregular periods. Schaumberg et al showed that the majority (74%) of athletes intentionally manipulated their oral contraceptive use to avoid their withdrawal bleed, with 29% manipulating this at least four times a year. It is of course an athlete’s personal choice to use hormonal contraceptives for contraceptive purposes. However, athletes should consider the potential implications of hormonal contraceptive use on their training, performance and health if they are not using their contraceptive for contraception purposes – ie, they may be using it to treat medical conditions like dysmenorrhoea, menorrhagia and acne.

Figure 3 is a guide of good practice for practitioners to be aware of when working with female athletes.

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#### EUMENORRHEIC MENSTRUAL CYCLE

| DAYS 1-5 | Low levels of progesterone and oestrogen stimulate the hypothalamus to secrete GnRH Pituitary gland releases LH and FSH and the ovary matures follicles in response to FSH |
| DAYS 6-10 | Dominant follicle develops Oestradiol levels increase faster than progesterone Endometrium thickens due to oestrogen |
| DAYS 11-14 | Oestrogen suppresses FSH production High oestrogen induces LH surge = ovulation Cervical mucose viscosity changes |
| DAYS 15-22 | Follicle releases ovum Ruptured follicle is corpus luteum and is a source of progesterone, this signals hypothalamus to reduce LH and FSH production Progesterone causes thickening of endometrium for implantation of embryo |
| DAYS 23-28 | Option 1: Sperm and ovum result in the formation of embryo Option 2: No fertilisation, corpus luteum deteriorates and progesterone synthesis stops; uterine lining will slowly start to break down |

#### ORAL CONTRACEPTIVE (COMBINED)

| DAYS 1-10 | Oestrogen in pill suppresses production of FSH No follicle development or increase in uterine lining |
| DAYS 11-21 | Low levels of progestin signal to hypothalamus and pituitary to prevent LH surge No stimulus for endometrial lining thickening and mucose production remains thick |
| DAYS 22-28 | Placebo pills enable a withdrawal bleed of some uterine lining |

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**Figure 2. Comparison between oral contraceptive (combined) and non-hormonal menstrual cycle**

GnRH – Gonadotropin-releasing hormone; FSH – Follicle stimulating hormone; LH – Luteinising hormone

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**Figure 3. Guide of good practice for practitioners**
The impact of oral contraceptives on sporting performance is difficult to interpret due to many factors: the lack of standardisation of oral contraceptives used in research studies (high and low dose users); failure to control the type of oral contraceptive used (progestin only, combined etc) by the participants; inter- and intra-individual variation in endogenous hormones; and an increase in the occurrence of type II errors (accepting a false null hypothesis). Research has not shown a change in strength and short-term high intensity performance between pill-taking and pill-free days; however, several studies used non-active participants and none used high level athletes.

However, when it comes to endurance performance, the results are varied. Rechichi and Dawson showed no effect of oral contraceptive use on a 200m swim time trial, although they showed that blood lactate levels were reduced and pH increased during the withdrawal (pill-free) phase. Conversely, Lebrun et al demonstrated, with highly trained athletes in a randomised, double blind, placebo-controlled study, that absolute and relative changes in VO_{2max} from follicular to triphasic oral contraceptive use decreased by 4.7%, whereas a +1.5% improvement was demonstrated in the placebo group. There was, however, a large individual variability within the results and no significant differences found in anaerobic speed test, aerobic endurance (time to fatigue at 90% of VO_{2max}), and isokinetic strength. Rechichi and Dawson showed that reactive strength from 45 cm box in team sport athletes was significantly lower in the late-withdrawal phase (158 ± 29 cm s^2) than in the pill consumption phase (178 ± 48 cm s^2). Redman and Weatherby found significant alterations in peak power output (433 ± 5 vs 449 ± 6 watts) and 1000m rowing ergometer time (227 ± 1 vs 231 ± 1 seconds) during the withdrawal phase, when exogenous hormones were absent. These studies highlight the lack of consensus in this area, due to the aforementioned methodological differences. Future research needs to address these issues and should employ more robust techniques where identical oral contraceptives are used and endogenous hormone blood sample are taken in well-trained athletes.

Monitoring the menstrual cycle

When a S&C coach is planning a programme, a key consideration should always be to consider the individual. It is advisable to record each athlete’s menstrual history, including age at menarche, contraception usage, time of last period and frequency of periods. Although a general consensus is that monitoring the menstrual cycle is important, how to collect valid and reliable data is yet to be established. Furthermore, education amongst athletes requires improvement: only 16% of athletes surveyed could identify both oestrogen and progesterone as female ovarian hormones that fluctuate throughout the menstrual cycle and only 18% knew that amenorrhea meant the absence of menstruation.

Hamilton used a 31-day cycle training approach during his time at GB Women’s Hockey (see Table 1 on next page). Although this table shows the application of theoretical research in an applied setting, practitioners need to be mindful that this model cannot simply be applied to all female athletes and would need to exclude hormonal contraceptive users and individuals with menstrual dysfunction; it would also need to be adjusted to the individual’s cycle length (that may also vary between months). Menstrual cycle tracking can be direct or indirect. Direct methods include blood, urine, saliva, ultrasounds of follicular development and biopsies of the endometrial. Although these methods would remove doubt of menstrual health, they are typically expensive, invasive and time-intensive. Indirect methods include body temperature, ovulation tests, use of questionnaires and apps; these methods would be quicker and more practical but some caution is still required. An app is easy and assessable for athletes and coaches, but users need to be mindful that apps are unable to exclude certain menstrual dysfunctions such as anovulation (menstrual bleeding occurs but ovulation does not) and luteal phase defects (short duration and/or insufficient progesterone).
### Table 1. Adapted from Hamilton

<table>
<thead>
<tr>
<th>MENSTRUAL</th>
<th>PHASE</th>
<th>HORMONE LEVEL</th>
<th>PHYSIOLOGICAL AND PSYCHOLOGICAL CHANGES</th>
<th>EFFECT ON TRAINING</th>
<th>WEEKS</th>
<th>FOCUS</th>
<th>INTENSITY</th>
<th>PRIORITY SESSION</th>
<th>SIMPLE TERMS</th>
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<tbody>
<tr>
<td>1</td>
<td>Early follicular</td>
<td>Oestrogen, progesterone and testosterone low</td>
<td>Changes in mood resulting in increased stress, accidents, poor reaction times and perception of exercise. Immune depression</td>
<td>Eliminate skill and precision training, reduce stress and training volume</td>
<td>1</td>
<td>Regeneration</td>
<td>Light</td>
<td>Mixed early light conditioning and start loading gym</td>
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<td>2</td>
<td>Mid follicular</td>
<td>Oestrogen rising, progesterone low</td>
<td>Include high intensity, low volume, complex tasks, anaerobic and power-based activity, lactic acid-based work and strength training</td>
<td>Metabolic and strength</td>
<td>2</td>
<td>Aerobic and injury prevention</td>
<td>Medium/ heavy</td>
<td>Conditioning</td>
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<td>3</td>
<td>Late follicular</td>
<td>Oestrogen peak</td>
<td>Increased low intensity and high-volume aerobic work. Emphasise non-weight bearing activities and prolonged exercise</td>
<td>Very heavy</td>
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<td>Maximal strength and power</td>
<td>Gym and speed</td>
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<td>Ovulation</td>
<td>Testosterone peak</td>
<td>Strength and power training</td>
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<td>5</td>
<td>Early luteal</td>
<td>Progesterone rising</td>
<td>Increased glycogen stores in liver and muscle tissue, decreased glycogen stores in blood glucose. Increase in total energy and fat intake. Depression of blood lactate concentration. Greatest retention of water, sodium, chloride and potassium</td>
<td>Include high intensity, low volume, complex tasks, anaerobic and power-based activity, lactic acid-based work and strength training</td>
<td>4</td>
<td>Aerobic and injury prevention</td>
<td>Medium</td>
<td>Conditioning heavy</td>
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<td>Mid luteal</td>
<td>Oestrogen and progesterone peak</td>
<td>Greater protein breakdown. Muscle endurance low. Increased glycogen storage, increased fat and protein. Increased water and electrolyte stores</td>
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<td>Late luteal</td>
<td>Oestrogen, progesterone and testosterone low</td>
<td>Changes in mood resulting in increased stress, accidents, poor reaction times and perception of exercise. Immune depression</td>
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Furthermore, given the high prevalence of oral contraceptives, athletes’ ‘cycles’ are exogenously controlled and may give a false indication of good menstrual health. What is most likely best practice is a combination of both direct and indirect methods throughout the season. Using data that allows the coach to alter training is a little less clear; tracking performance throughout the cycle may help determine if the athlete is maximising performance by being responsive to changes that may occur at various points of the menstrual cycle. Barker suggests that females who do not suffer too badly from premenstrual syndrome (PMS) or experience heavy menstrual bleeding (heavy periods) can mostly use a traditional periodisation approach (linear/block), whereas other sportswomen would need to train harder during the follicular phase and reducing training during the luteal phase.

**Injury**

As female participation in sport increases, so too will the occurrence of injuries; females incur more stress fractures, shoulder (subluxation and dislocation) injuries, patella femoral pain, ankle sprains, and ACL injuries. Menopause is associated with an increased risk of musculoskeletal injury, as oestrogen and other female hormones decline. It is proposed that females experience higher rates of concussion than male athletes, with a smaller head size and less musculature around the neck proposed to explain these differences, although interpreting these data can be difficult as both males and females tend to under-report symptoms. Some men have a greater upper limb strength, stronger rotator cuff and periscapular muscles, whereas some women have greater anterior glenohumeral laxity and decreased stiffness, which could negatively impact shoulder subluxation and dislocation risk.

Interestingly, women and men use different strategies to control the ankle joint when standing or walking; furthermore, ligamentous laxity of the ankle joint has been shown to be greater in women, which helps explain why women sustain ankle sprains nearly twice as often as men. Females are at greater risk for overuse injuries (tendinitis, bursitis, medial tibial stress syndrome, and stress fractures). Among collegiate athletes, females had a higher rate of overuse injury than male athletes (25 vs 13 per 10,000 athlete exposures (exposure was calculated by coach directed session)). It is important to remember that bone mineral density can be affected through low energy availability, disordered eating, menstrual dysfunction and/or delayed menarche.

Anterior knee pain has been shown to be higher in females, with the estimated prevalence of anterior knee pain in 18-35 year old females at 12-13%. Females with a larger Q angle (angle between the anterior superior iliac spine and midpoint of the patella) are more prone to lateral maltracking of the patella. However, scientific proof supporting this anatomical theory is limited and practitioners are better off focusing on landing mechanics (in particular, more trunk flexion and no valgus) and exercises that improve gluteal muscles (single leg squats, single leg RDLs, miniband exercises etc).

A lot of research into injuries in female athletes focuses on the anterior cruciate ligament (ACL), because of the severity of these types of injuries and the duration of rehabilitation following injury. Female athletes in jumping and cutting sports are four to six times more likely to sustain a serious knee injury compared to males. Risk factors for a non-contact ACL injury include: anterior tibial shear stress from quadriceps contraction, near full knee extension and deceleration with a planted foot, with the knee internally rotated and in valgus. Research into ACL injuries involving the menstrual cycle is emerging: ovulation has been associated with a reduction in knee stiffness and ACL injury. In eumenorrheic women, knee laxity increased from 4.7 ± 0.8mm in the follicular phases compared to 5.3 ± 0.7mm in the ovulatory phase, which is proposed to explain increased knee injury risk given that a 1.3mm increase in knee displacement increases ACL injury risk four-fold.
The majority of studies investigating cycle phase and injury risk have used subject self-recall to establish menstrual cycle status. It is important to note that hormone milieu can change substantially near ovulation, and that follicular and luteal phases can vary in length significantly. Tourville et al suggest caution regarding the accuracy of retrospective menstrual cycle phases classification systems, given the high occurrence of anovulatory cycles. The use of single hormone samples to ascertain hormone status has been shown to be erroneous: it is unable to determine if hormones are rising, peaking or falling. More conclusive evidence is needed to ascertain how – or indeed if – the sex hormones alter the mechanical properties of muscle, tendon, or ligament in vitro or in vivo in eumenorrheic women.

It is believed that taking oral contraceptives can reduce the risk of ACL risk by stabilising endogenous hormones. However, as so often with research around exogenous hormones, the effects may or may not differ with the administration of different oral contraceptives (monophasic, biphasic, triphasic and the type, potency and androgenicity of progestins). Currently, there is no clear evidence on the effects of oral contraceptives on ligament/ACL risk. In a review by Herzberg et al, ACL injury risk was assessed across menstrual cycle (outside of the scope of this paper). Risk factors for ACL injuries involve both intrinsic (player-related) and extrinsic (environment-related) elements; practitioners would benefit from focusing on extrinsic factors such as improving neuromuscular control, or by introducing or modifying programmes such as the PEP (Prevent Injury and Enhance Performance) from the Santa Monica Sports Medicine Foundation into their current practice.

Breast health

Education of young females requires improvement, as more than 50% of 2,000 females, aged between 11 and 18 years and based in the UK, have reported never wearing a sports bra during sports, even though breast bounce is a major breast health concern. Data in elite, adult female athletes is currently unavailable. Breast problems can present a real barrier to exercise participation; they also account for a high occurrence of pain in exercising females that is exacerbated in high intensity sport. Running with low breast support can lead to increased muscle activation in the pectoralis major, anterior and medial deltoid. Furthermore, low breast support is associated with increased ground reaction forces closely aligned with a reduction in economical running kinematics and a lower breathing frequency. However, conflicting research has shown that ground reaction forces and other physiological variables were unaffected by breast support changes during running.

White et al showed that although a high support bra reduced breast kinematics and decreased breast pain, it did not influence thorax and arm kinematics. As breasts have limited internal anatomical support, it is recommended that external support be used or else the athlete risks irreparable damage and increases the likelihood of breast ptosis (ie, sag). Multidirectional breast displacement during running, star jumps and horse riding has been reduced with high support sports bras. Compression bras are perceived to be suitable for < D cup breasts, whereas encapsulation bras offer more support to > D cup breasts. Further advice for choosing a ‘good’ sports bra includes: having a wide vertical adjustable strap; ensuring the back has...
adjustability but not elastic qualities; having a high neckline (reaches the upper boundary of breast tissue); being comfortable and providing the level of support suitable for the intensity of the exercise.64,65,156

**Coaching and psychology**

It should be stated that there are more similarities than differences between the sexes with regards to psychology; however, the subtle differences that exist can have a significant impact on performance. Differences between sexes can occur in goal orientation, sources of confidence, cohesion and preferred coaching styles.18

Apart from performance pressures, females face additional stressors through patronising attitudes, gender stereotypes and unequal treatment.58,118 The female athlete is more likely to experience sexual harassment and/or abuse; data from sports students (mean age 22 years) reported that 34% of females experienced sexually harassing behaviour from a man and 12% from a woman, which negatively impacted their self-esteem and heightened their anxiety.64,65,85,118

Tailoring the coaching and support offered to female athletes will benefit the individual and the team.51,83,195 Personal goals and standards instil confidence in world class female athletes, whereas males tend to derive confidence from interpersonal comparison and winning.62 Female athletes score higher in task-orientation and lower on levels of ego orientation and place less emphasis on winning and competitiveness.56,61,29 Furthermore, females have lower feelings of efficacy and lower confidence levels.75,144 However, females have a greater motivation to create and maintain close relationships and a greater need for positive communication and belongingness, which are essential given the importance of cohesiveness to success in female teams.70,25,104

Norman and French195 showed that, in the UK, the coach occupies a powerful and often over-bearing role in the lives of high-performance women athletes, but that a more democratic, personalised and positive coach-athlete relationship can prove instrumental in improving women athletes’ experiences of performance sport. Sportswomen are more likely to want to explore rationales for decisions and often want to play some part in the decision-making process, thus highlighting the need for a good coach/athlete relationship and communication.195

Failure of male coaches to understand how best to engage with female athletes has been shown to be a key barrier to participation, engagement, and progression.193,104 The strength and conditioning profession is a largely male-dominated profession, and therefore there is a likelihood that female athletes will be supported by a male-dominant team. It could be misperceived that having male coaches for female athletes is not an ideal situation, given their inability to fully understand the female athlete; however, research specifically investigating attitudes towards and preferences for male and female S&C coaches showed that female athletes do not demonstrate a sex preference, or negative attitudes towards a male coach.14 In contrast, males prefer working with a male strength coach, no matter how qualified the female coach is.66 Magnusen and Rhea14 suggest that male athletes in male-dominant sports may need education on how gender does not dictate expertise and that athletes should be focused on the coach’s experience and teaching ability, rather than on gender.

S&C coaches may have to pay particular attention to younger female athletes, since they are likely to have a lower perception of their athletic ability and sometimes are less able to perform resistance training.56,111 If they perceive S&C training to be a masculine activity, further issues can arise;50 as such, it would be beneficial for the coach to dispel myths around strength training, explain why DOMs occur and promote the benefits of strength and conditioning in order to increase female athletes’ engagement with strength training programmes.

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