The 2019 Biennial International Female Athlete Conference Proceedings

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History of the Female Athlete Conference

Established in 2013, the Biennial International Female Athlete Conference (FAC) was originated with the purpose of providing a global forum for the dissemination of current strategies to prevent and treat clinical issues and injuries specific to female athletes. As young women and girls become more empowered through sports, it is important to advance research on how sex and gender differences affect athlete performance and sports experience. With its unique topic area, the FAC is the first and largest conference of its kind, and thus presents a rare and critical opportunity to address health issues specific to girls and women in sport. All proceeds from the conference support the research of female athletes to help promote optimal performance, injury prevention, and return to sport.

With research advancements in mind, the FAC centers on the specific health issues that make female athletes unique. The goals of the FAC are multifaceted and focus on the interdisciplinary care of female athletes. One key aim is to improve attendees’ awareness and comfort level in managing salient issues for the modern female athlete (e.g., female-specific equipment, fertility, exercise and pregnancy, anger management, transition out of sport, navigation of sexualization of women in sport, female athlete empowerment), and to provide updates about more traditional topics [e.g., anterior cruciate ligament (ACL) updates, new concussion and head injury information, injury rehabilitation, Relative Energy Deficiency in Sport (RED-S), and nutritional needs of female athletes]. Another important aim of the FAC is to provide networking opportunities to improve research and female athletes’ training, confidence, and motivation to advance their success on and off the field.

Introduction to the 2019 Conference

Why This Theme?

The FAC focuses on the unique needs of female athletes. Females differ from males in many aspects of general health, sport performance, training, and management for sport-related injuries (Boullosa et al., 2020; Covassin, Swanik, & Sachs, 2003; Henry & Kaeding, 2001; Hilibrand et al., 2015; Rossi, 2017). These differences need to be recognized in order to tailor research and treatment to female athletes. Sports participation reaps many health, academic, and social benefits, and with female sport participation at an all-time high (Wolverton, 2012; International Olympic Committee, 2019), it is paramount that the medical and sports communities understand the nuances of treating females in sport. Far too often, the assumed needs of female athletes are based off of conclusions reached from research involving male athletes. The lack of widespread knowledge about the differences in physiology, hormones, musculoskeletal systems, symptom severity, and injury prevention, among others, can be detrimental to female athlete sports performance and health. This conference brings together international experts to facilitate education and collaboration to improve outcomes and empower female athletes worldwide. Ideal practice is interdisciplinary medical care and evidence-based coaching for women.

Conference Tracks

The conference provided attendees with various options and flexibility to create their own individualized experience. Tracks featured topics under the categories “Medical,” “Nutrition,” “Coaching,” “Allied Health,” and “Mental Health,” as well as some crossover topics that spanned several of the aforementioned themes. The categorization of tracks facilitated an attendee’s ability to select presentations that were most relevant to their work with female athletes. Additionally, general themes provided attendees freedom to explore areas with which they were less familiar. Within the “Medical” track, presentations included discussion around menstrual/hormonal functioning in female athletes and anatomical risk factors for injury, with a specific focus on ACL and reproductive health. Other topics included contraceptive use and sport specialization. “Nutrition” topics incorporated dietary interventions for exercise-related hypothalamic amenorrhea, fad diets in female athletes, as well as energy availability. The “Coaching” and “Allied Health” track included subjects such as training workload, equipment/footwear, coaching strategies, and sport techniques specific to the female athlete. The “Mental Health” track focused on psychological risk factors, performance-based psychology, and body image issues. Lastly, the cross-over topics included sport-specific lectures on gymnastics, Pilates, and cycling, as well as motherhood in elite female athletes and transition in and out of sport.

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Summary of Keynotes
The keynote addresses set the tone for the 2019 FAC by highlighting extraordinary speakers who are dedicated to supporting female athletes. Dr. Phathokuhle Zondi, Dr. Cheri Blauwet, and professional athlete, Allie Kieffer, shared their remarkable personal and professional stories that reflected on the conference’s overarching themes of opportunity, inclusivity, and challenges for women in sports.

The keynote addresses were strategically scheduled between other general session talks by prominent speakers, setting the stage for inspiration and thought. Some of these topics included: “How Women Coaches Can Change the World” (Julie McCleary, PhD), “The Global Impact of Social Running on Women” (Katherine Switzer, MS, Edith Zuschmann, MS, Juliet McGrattan, MD), and a “Life After Sport” panel discussion with Bassey Akpan, MS, Melissa Streno, PsyD, CMPC, Rebecca McConville, MS, RDN, LDN, CSSD, CEDRD, Kirbi Kidd, MEd, Erin Reifsteck, PhD, and DeAnne Brooks, PhD.

Sports medicine physician, Dr. Phathokuhle Zondi, provided a riveting international perspective in her keynote, “Empowering Female Athletes in South Africa.” She discussed the sociocultural, environmental, and personal barriers women face in order to gain access to sport and/or activity in South Africa, barriers often rooted in economic disparity. She also described the challenges elite South African female athletes endure, including limited financial support and access to resources, compared to their elite female athlete counterparts in other parts of the world. Drawing from her experiences working with and advocating for athletes, serving as the former president of the South African Sports Medicine Association, and her current leadership role in the Sport Science Institute of South Africa, she outlined how policy, social development initiatives, and growing awareness can optimize sport performance, access to sport, and health for South African female athletes, as well as athletes across the globe.

Physical Medicine and Rehabilitation sports medicine specialist and seven-time Paralympic medalist, Dr. Cheri Blauwet, gave a heartfelt account of her extraordinary life story, beginning as a child with a disability in rural Iowa who ultimately found passion, determination, and a sense of belonging through wheelchair racing and athletics. She serves as the Disability Access and Awareness Director for the Spaulding Rehabilitation Network, is on the board of directors of the United States Olympic and Paralympic Committee, is a member of the International Olympic Committee’s Medical and Scientific Commission, and is the past chairperson of the International Paralympic Committee’s Medical Commission. She spoke of setting high expectations for herself, dreaming big, and taking risks throughout her athletic career. Dr. Blauwet also shared how she is a fierce advocate for adaptive athletes and is working to create “a world where you don’t have to be lucky to be successful”. She is using her platform to increase recognition and resources for US Paralympic athletes, including advocating for equal payouts for US Olympic and Paralympic athletes, a resolution that was passed in 2018.

Oiselle-sponsored professional American distance runner, Allie Kieffer, shared her passion for running in the face of criticism for not having the traditional ultra-lean “runner” body type. Allie spoke candidly about her struggles with body image earlier in her running career and through interactions on social media. She described how she has learned to treat her body with respect and rise above negativity. She instead uses it to fuel her ambition for success. In response to a question from the audience regarding the coach’s role in commenting on an athlete’s body or weight, Allie stated that, “We are athletes, not objects. The conversation should not be about our bodies”. She advocated for staying healthy by working with a team of specialized sports medicine professionals, such as a registered dietitian. Allie’s conversational platform allowed the audience to engage with an athlete who is challenging the conventional norm and finding joy and success in the process.

Abstract Summaries
Presentations: Day 1, Track 1
Hormonal contraceptive use in elite female athletes
Kirsty Elliott-Sale, PhD, FHEA; Clare Minahan, PhD; Brianna Larsen, PhD
Hormonal contraceptives (HC) are used by many female athletes; a study of 430 elite female athletes found that 49.5% were using HC and 69.8% had used HC at some point in time (Martin, Sale, Cooper, & Elliott-Sale, 2018). Drs. Elliott-Sale, Minahan, and Larsen are researchers with a common interest in human performance and the effect of hormones on elite female performance. Numerous physiologic systems that may affect athletic performance—for better or worse—can be altered by this systemic administration of exogenous hormones. The most common observed effects of HC use were changes in the menstrual cycle, including regulating periods, reducing menstrual symptoms, and altering menstrual cycles by causing cessation of periods or less frequent periods (Martin et al., 2018). Australian female athletes ages 16 and older were surveyed for their knowledge about the menstrual cycle and combined oral contraceptive (COC) use. This study found that these athletes possessed poor knowledge about how COC affects physiology; yet nearly 50% of the athletes surveyed used COC (Larsen, Morris, Quinn, Osborne, & Minahan, 2020). Overall, HC have few proven effects on athletic performance; larger, more well-controlled studies on specific HC formulations are needed; and athletes should consider their health and goals when selecting a contraceptive method.

The female athlete and the ACL: How, why, and psychological implications for recovery and return to sport
Melissa Christino, MD; Corinna Franklin, MD; Cordelia W Carter, MD
Drs. Christino, Franklin, and Carter are orthopedic surgeons dedicated to improving outcomes for female athletes. Dr. Christino is a member of the Female Athlete Program at Boston Children’s Hospital; Dr. Franklin directs the Female Initiative: Evaluation and Rehabilitation Care Excellence (FIERCE) program for female athletes at Shriners Hospitals for Children; and Dr. Carter is the director of the Women’s Sports Center at NYU-Langone Medical Center. Female athletes are more likely to sustain ACL injuries than their male counterparts, and these ACL injuries have long-lasting effects on quality of life irrespective of surgery (Arentd, Agel, & Dick, 1999; Beynnon et al., 2014). Numerous etiologies for this increased risk for injury have been proposed, including smaller ACLs compared to males, changing hormonal milieus, and greater Q angles in women than men (“The Female ACL,” 2016). Modifiable risk factors include neuromuscular control and biomechanics. Prevention programs targeting these modifiable risk factors have reduced ACL injury incidence. A study conducted on 600 Italian soccer players found that the athletes who participated in balance and proprioceptive training for 20 minutes per day had a lower incidence of ACL injuries compared to controls (Caraffa, Cerulli, Progetti, & Rizzo, 1996). A neuromuscular and proprioceptive program implemented in 1041 female youth soccer players decreased the incidence of ACL injuries by 88% in the first season and 74% in the second season in comparison to controls (Mandelbaum et al., 2005). When an ACL injury occurs, surgical intervention is often indicated. Children and adolescents are skeletally immature, and the level of skeletal immaturity dictates the type of procedure used to carry out the repair. Athletes who sustain ACL injuries are at risk for profound psychological sequelae, including increased anger and depression and decreased self-esteem (Brewer & Cornelius, 2010; Mainwaring, Hutchison, Bisschop, Comper, & Richards, 2010). Athletes frequently fear reinjury.
What we know and what we don’t know about female athletes and head injuries
Donna Duffy, PhD
Dr. Duffy is the Director of the Program for Advancement of Girls and Women in Sport and Physical Activity at the University of North Carolina at Greensboro. Her research focuses on understanding the role of hormones in head injuries. Concussions are brain injuries that cause temporary changes in behavior or cognitive function. The prevalence of sports-related concussions is higher in female athletes than male athletes participating in similar sports. In a study of nearly 15,000 reported injuries, females sustained 471 concussions during practices and games, while males sustained 402 (Covassin et al., 2003). Females can experience more severe and longer-lasting concussion symptoms than males; this has been partially attributed to neck size and neck strength, as well as better symptom reporting (Barnes et al., 1998). The menstrual cycle has been theorized to play a role in severity and length of concussive symptoms, though data at this time are inconclusive. Female athletes who sustain a concussion should be immediately removed from the playing field. Further research is needed to understand the sex-specific factors implicated in recovery from concussion.

Various treatment options for tendinopathies
Adam Tenforde, MD; Kelly McInnis, DO
Female athletes are at particular risk for tendinopathies of the gluteus medius, gluteus minimus, and proximal hamstring (Grimaldi et al., 2015). Drs. Tenforde and McInnis, both physical medicine & rehabilitation specialists, discussed various treatments for these common, nagging injuries in female athletes. Gluteal tendinopathies arise insidiously and are most sensitively detected on physical examination by palpation over the greater trochanter; MRI is the most sensitive imaging modality. Various treatment options for tendinopathies can improve pain and function in the short-term, but do not have longer-term benefits compared to typical treatment modalities such as conventional treatment (combination of physiotherapy, NSAIDs, and cortisone injections) (Cacchio et al., 2011). Extracorporeal shockwave therapy (ESWT) for four weeks has been shown to vastly improve return to sport rates compared to conventional treatment (combination of physiotherapy, NSAIDs, and structured exercise program) (Cacchio et al., 2011).

Presentations: Day 1, Track 2

The gym SAFE movement screen: To predict health and biomechanical faults in female gymnasts
Jennifer Kinder, PT, MS, DPTSc; Todd Davenport, PT, DPT, MPH, OCS; Alyssa Herrera-Set, PT, DPT, SCS, PMA-CPT; Jessica Wickizer
Female gymnasts experience the second most severe injuries among all NCAA sport participants (Kay et al., 2017). The gymSAFE Movement Screen, developed by Alyssa Herrera-Set and Jessica Wickizer and presented with University of the Pacific’s Physical Therapy Program Director, Todd Davenport, and Notre Dame de Namur’s Kinesiology Program Director, Jennifer Kinder, is a novel assessment tool that identifies movement errors that can lead to gymnastics injuries. It is the first gymnastics-specific screening tool for injury risk. The gymSAFE screen incorporates measures of strength, flexibility, and movement to provide an “at-risk” score for each body part. Based on the results of the gymSAFE screen, specific exercises to reduce risk of injury can be prescribed.

Pilates for the female athlete: The key to core strength and stability
Kurt Gorrell, DPT, CSCS, ACSM-CEP
As a dance veteran with a 16-year dance career on Broadway and multiple national dance tours, in addition to his Doctorate in Physical Therapy and certification as a Pilates instructor, Kurt Gorrell presented how Pilates is beneficial to female athletes beyond simple core muscle strengthening. Athletes who engage in sports that require extreme flexibility are at increased risk for hyperextension injuries. In these athletes, Pilates allows for muscular strength improvement without the loss of flexibility. Furthermore, Pilates can be used for injury prevention and rehabilitation from injury of the extremities and for improved pelvic floor function (Bryan & Hawson, 2003; Lugo-Larcheveque, Pescatello, Dugdale, Veltri, & Roberts, 2006). Research in patients recovering from partial ACL injury found that those participating in Pilates had improved outcome measures compared to controls who did not receive an exercise program (Çelik & Turkel, 2017). Further research comparing Pilates to other treatments for injury prevention and rehabilitation will elucidate the value of Pilates for specific injuries.

Unique issues in female cyclists
Rozanne Puleo, FNP-BC, ONP-C, ACSM- RCEP, ACSM-CEP; Dana Kotler, MD
In the United States, cycling is a male-dominated sport, with men’s cycling trips more than double those of women’s (Baker, n.d.). Dr. Kotler, founder and director of the Spaulding Cycling Medicine Program, and Rozanne Puleo, orthopedic nurse practitioner and two-time Masters US National Mountain Bike Champion, shared medical considerations for the female cyclist. Cycling is the most common sports-related cause of traumatic brain injury (TBI) in women; helmets reduce the risk for such injuries (Coronado et al., 2015; Elvik, 2011). Women are also at risk for breast injury secondary to a cycling accident; these injuries include hematoma, thrombophlebitis of the superficial breast veins (Mondor’s disease), and capsular hematoma or implant rupture of an augmented breast. Female cyclists are at high fracture risk in a bike accident (Poulos et al., 2015). Cycling is non-osteogenic and emphasizes leanness, placing participants at high risk for poor bone mineral density (Scofield & Hecht, 2012). Bicycle fit plays a major role in preventing hip pain and patellofemoral pain from cycling itself. Saddle fit is particularly important for pelvic positioning and gynecologic health (Trofaier, Schneidinger, Marschalek, Hanzal, & Umek, 2016). Female cyclists can experience pudendal neuralgia, vaginitis, labial hypertrophy, and saddle sores, from ill-fitting saddles, some which can be alleviated by a proper seat fit.

Does it fit? sports bras, sports equipment, and female athletes
Katherine Rizzone MD, MPH; Emily Kraus, MD
Dr. Rizzone, sports medicine physician at the University of Rochester Medical Center and medical director of the Run URMN clinic, presented on the history and important features of the sports bra. Seventy-two percent of exercising females have reported exercise-related breast pain and women
who are embarrassed by excessive breast movement may not choose to participate in athletic activity (Bowles, Steele, & Munro, 2008). Sports bras are a critical piece of equipment for many female athletes. Sports bras vary in design and function, with the most well-designed sports bras providing upward support and consisting of absorbent fabric and straps that will not slip off shoulders. Researchers inquiring about sports bras characteristics determined that marathoners tend to value a bra that has firm support, an all-elastic back, and no lace, padding or underwires, while collegiate athletes value a bra that is inexpensive, easy to care for, and has seamless cups (Gehlsen & Albohm, 1980; Hunter & Torgan, 1982). High breast support has been shown to improve running kinematics and is recommended for female runners (Milligan, Mills, Corbett, & Scurr, 2015). Further research on sports bra and breast mechanics could better inform sports bra design to provide better support for more female athletes.

Presentations: Day 1, Track 3

Mind games: Mental skills and mindfulness for peak performance
Kelsey Griffith, MS; Marilou Shaughnessy, PsyD
Kelsey Griffith, Performance Enhancement and Rehabilitation Specialist at the Michieli Center for Sports Injury Prevention, and Marilou Shaughnessy, psychologist and certified practitioner in stress management and resilience training at Newton-Wellesley Hospital, discussed how attitude and mental health play an integral role in athletic performance. Concepts from cognitive behavioral therapy can be applied to athletes to improve performance and resilience. Identifying negative thoughts increases awareness of self-destructive behaviors. Reflecting on previous positive experiences and identifying why that experience was positive puts the athlete in a successful mindset. Research in athletes ages 15-58 found that mental toughness was associated with coping strategies and optimism (Nicholls, Polman, Levy, & Backhouse, 2008). When injury arises, it’s important to take a holistic approach to recovery and apply these concepts to the recovering athlete. Mental health skills such as positive self-talk and mental imagery can help injured athletes manage psychological stressors (Nippert & Smith, 2008).

Simple steps to navigating the appropriate college for student athletes
Cassandra Cunningham, MEd
Former national team rower and collegiate coach, Cass Cunningham, discussed the importance of organization, communication and professionalism when navigating the recruiting process for high school athletes. The college application process has become increasingly competitive and stressful for high school students. According to the National Center for Education Statistics, fall enrollment in college rose 12% between 2006 and 2016 (National Center for Education Statistics, n.d.). Student athletes feel pressure from many stakeholders who may have conflicting interests. Understanding each sport’s recruiting cycle and process improves an athlete’s likelihood of being recruited. Often, a prospective student visits a college of interest, either in an “unofficial” or “official” capacity starting on September 1st of the student’s junior year of high school. Prospective students are allowed unlimited unofficial visits that are paid for by the student and five official visits with expenses covered by the institution. During the application process, athletes must consider their drive for being a collegiate athlete and ensure that they are selecting a program that is appropriate for their own personal goals.

Becoming an ally, developing allies
Brian Garity, PhD, ATC, CSCS
Athletic trainer and assistant professor at the University of Denver, Dr. Garity, spoke on the importance of allies for female athletes. Allies are people outside of a situation who have no direct benefit from improving a situation. Allies are often people of privileged status who work to end oppression. These allies are also charged with teaching and recruiting new allies. Collegiate sports are dominated by male authority figures, including coaches, strength and conditioning specialists, and administrators, which can create challenging situations for female athletes. To create a safe environment for female athletes, it is imperative that males refrain from stereotyping femininity (e.g., “throws like a girl”), allow equal opportunities for male and female coaching hires, and educate male coaches on female-specific health concerns.

Mental health considerations: Strengths and stressors of being a collegiate athlete
Caitlin Nevins, PsyD; Katherine Record, JD, MPH; Stephanie Pinder-Amaker, PhD
Dr. Pinder-Amaker, founding director of McLean Hospital’s College Mental Health Program, Dr. Nevins, clinical psychologist at McLean Hospital, and Katherine Record, attorney and Executive Director of the Lahey MassHealth Accountable Care Organization, discussed how collegiate female athletes face a “quadruple threat” of mental health risk factors: common student stressors, including achievement demands, new environment, alcohol and drugs, and shifts in sexual identity; unique female student stressors, including increased risk for sexual assault and harassment; common student-athlete stressors, including lack of time, pressure to perform and obtain playing time, injuries, lowered self-esteem, and athletic identity; and unique female athlete stressors, including female athlete triad (Triad) and harmful media messages. The emotional preparedness model emphasizes that the athlete and members of the athlete entourage can improve the mental well-being of the athlete through self-care, controlling negative behaviors and feelings, building healthy relationships, and properly adapting to new environments. Entourage members can provide education on topics such as sleep hygiene and available resources on campus. They can also provide a non-judgmental ear to listen to an athlete’s concerns and work to build a positive, supportive, team culture.

Presentations: Day 2, Track 1

Female athletes, amenorrhea, and fertility: Implementing the current research into clinical practice
Robyn Nohling, FNP-BC, RD, RDN, MSN; Nicola Rinaldi, PhD
Robyn Nohling, registered dietitian and nurse practitioner specializing in eating disorders and women’s health, and Dr. Rinaldi, researcher specializing in hypothalamic amenorrhea and author of No Period, Now What? discussed menstrual disturbances in female athletes. Many female athletes experience amenorrhea or other forms of menstrual dysfunction (Dadgostar, Razi, Aleyasin, Alenabi, & Dahaghin, 2009; Nichols, Rauh, Lawson, Ji, & Barkai, 2006; Verrilli, Blanchard, Landry, & Stancic, 2018). This menstrual disturbance can be accompanied by poor bone health and inadequate energy availability in syndromes known as Triad or Relative Energy Deficiency in Sport (RED-S) (Mountjoy et al., 2014). Recovery from Triad and RED-S requires restoration of adequate energy availability by increasing caloric intake and reducing exercise energy expenditure, as well as by managing stress (Rinaldi, 2016). When evaluating menstrual health, it is important to account for contraceptive use: a woman using COC may bleed monthly but be truly amenorrheic—that is, if she stopped using the pill, she would not have regular menses (Gordon et al., 2017). Furthermore, not all bleeds are ovulatory, indicating ongoing hormonal abnormality. Current data suggest, however, that periods of amenorrhea and anovulation do not negatively affect long-term fertility once ovulation is restored (Hind, 2008).
It’s all about teamwork: How the EDIT team at the university of connecticut manages eating disorders and the case they will never forget

Deena Casiero, MD; Patti Kula, ATC; Dawn Shadron, LCSW

The multidisciplinary team approach is considered the gold standard for the treatment of eating disorders (Ozier, Henry, & American Dietetic Association, 2011; Stewart & Williamson, 2004). Dr. Casiero, Director of Sports Medicine and Head Team Physician, Patti Kula, Assistant Athletic Trainer, and Dawn Shadron, Director of Student Athlete Counseling and Mental Health Services, discussed their team-based approach at the University of Connecticut (UConn). The UConn Eating Disorder Interdisciplinary Team is composed of physicians, sports nutritionists, licensed mental health specialists, and athletic trainers. This team meets twice monthly to review cases and treatment plans, identify common issues across cases, and standardize policies. Each member of the team has a specific role in caring for athletes with eating disorders according to their expertise. While the physician is the leader of the team, they rely on other team members to implement the agreed upon plan and track the progress of the athletes.

The reintroduction of physical activity a dilemma in the treatment of anorexia nervosa

Ralph E. Carson, PhD, RD

Registered dietitian, exercise physiologist, and Senior Clinical and Research Advisor for the Eating Recovery Centers, Dr. Carson spoke about considerations for incorporating physical activity into eating disorder treatment. Excessive exercise is common in patients with anorexia nervosa (AN), with estimates reaching 80% (Davis et al., 1995, 1997). The Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition specifically cites excessive exercise as a characteristic of restrictive AN (American Psychiatric Association, 2013). Importantly, exercise has anti-depressant effects through serotonin release and addictive qualities through dopamine release (Meeusen & De Meirleir, 1995). Consequently, exercise needs to be managed carefully when treating AN (Calogero & Pedrotty, n.d.). Gradual reintroduction of exercise once a patient has been refed to 90% of expected body weight has many positive effects on recovery. These patients, however, must be monitored carefully to prevent furtive exercise. The Safe Exercise at Every Stage (SEES) guidelines assist in clinical decision-making regarding exercise during eating disorder treatment for adults by utilizing risk assessment and a step up/step down approach to mirror clinical progression (Dobinson, Cooper, & Quesnel, n.d.). Low intensity exercise is recommended in early stages of recovery and can include yoga and tai chi.

Avoidant/restrictive food intake disorder (ARFID)

Ovidio Bermudez, MD, FAAP, FSAHM, FAED, CEDS

Chief Clinical Officer at Eating Recovery Center and eating disorder treatment expert, Dr. Bermudez, discussed avoidant/restrictive food intake disorder (ARFID), a feeding disorder primarily affecting children and adolescents. According to the diagnostic criteria, individuals with ARFID fail to meet nutritional needs due to lack of interest in food, avoidance due to food’s sensory characteristics, or concern about consequences of eating. Those with ARFID may experience significant weight loss, poor growth, and nutrient deficiencies as well as impaired psychosocial functioning. Fisher, et al. found that those with ARFID often have a history of selective eating, anxiety, gastrointestinal symptoms, history of vomiting, choking, and food allergies (Fisher et al., 2014). Nicely, et al. explored the prevalence of ARFID patients seeking day treatment for an eating disorder and found that 22.5% (n = 39) of patients met ARFID criteria (Nicely, Lane-Loney, Masciulli, Hollenbeak, & Ornstein, 2014). ARFID’s clinical presentation varies and it is a newer diagnosis, meaning that those with ARFID may be misdiagnosed or experience a delay in diagnosis. ARFID has been categorized into 5 subtypes: avoidant, aversive, restrictive, mixed type, and ARFID “plus”.

Identifying ARFID type is the first step in management and treatment, which includes the coordination of medical, psychiatric, and nutritional care. Strandjord, et al. assessed the outcomes of hospitalized ARFID patients in comparison to patients with AN and found that ARFID patients, despite having less weight loss and bradycardia, required longer hospital stays and needed enteral nutrition more often (Strandjord, Sieke, Richmond, & Rome, 2015).

Presentations: Day 2, Track 2

Pelvic anatomy and pelvic floor physical therapy

Melissa A. Carroll, PhD; Karen Snowden, PT, DPT, WCS

Dr. Carroll, assistant professor in the Doctor of Physical Therapy Program at DeSales University, and Dr. Snowden, physical therapist specializing in women’s health and education on pelvic and obstetric physical therapy, spoke about the female athlete’s pelvic floor. Pelvic floor dysfunction is common in female athletes, with one in four U.S. women reporting moderate to severe symptoms during exercise (Nygaard & Shaw, 2016). Pelvic floor dysfunction can manifest as bowel or bladder urgency or incontinence, overactive bladder, constipation, pelvic organ prolapse, or pelvic pain. Particularly notable to athletes is the high rate of stress urinary incontinence, which can be caused by reduced rates of force development in the pelvic floor musculature (Moser, Leitner, Baeyens, & Radlinger, 2018). Risk factors for urinary incontinence in female athletes include intense exercise (especially high impact for prolonged time periods), eating disorders, and the combination of the two (Araújo et al., 2008; Carvalhais, Araújo, Jorge, & Bo, 2019). Physical therapy can improve many sequelae of pelvic floor dysfunction and is the first-line therapy owing to its efficacy and absent side effect profile (Goldstick & Constantini, 2014). In a study of seven physically active females undergoing an 8-week pelvic floor rehabilitation program, participants developed increased pelvic floor muscle strength and had a reduced frequency of urinary incontinence episodes (Da Roza et al., 2012). Athletes who experience urinary incontinence, urgency, frequency, constipation, bowel incontinence, or pelvic pain (including dyspareunia) should be referred to a pelvic floor physical therapist.

Does slow and steady really win the race? What exercise physiology teaches us about the tortoise and the hare

Pat Vehrs, PhD

Exercise physiologist, Dr. Vehrs, discussed the biological adaptations that take place with exercise and how exercise physiology captures and assesses these changes. Across sports, the differences in performance between men and women are decreased in longer distance endurance events. Aerobic performance is largely determined by VO₂max, lactate threshold, and economy of movements can improve performance when VO₂max can no longer be increased (Seiler, 2010).
Early sport specialization and the impact of the adolescent female athlete

Whitney Chambers, PT, DPT, OCS; Marcus Davy, PT, DPT, OCS, CSCS; Leonard Gordon Jr., PT, DPT, OCS; Matthew Fazekas, MD, FAAP, CAQSM

Practicing physical therapists at Joe DiMaggio Children’s Hospital U18 Sports Medicine program, Dr. Chambers, Dr. Davy, and Dr. Gordon, and sports medicine physician at Joe DiMaggio Children’s Hospital and consulting physician for US Figure Skating, Dr. Fazekas, discussed early sport specialization in female athletes. Early sport specialization is defined as training for a single sport for more than eight months in a year at the exclusion of all other sports. The prevalence of sport specialization in the high school setting varies from 22% to 48% (Bell et al., 2016). Specialization has serious economic costs as well as a high risk of burnout due to manipulation of the athlete by other stakeholders, overdependence of the athlete on the sport, and social isolation to make time for training (Michael Normand, Wolfe, & Peak, 2017). Early specialization places athletes at high risk for low energy availability and RED-S. Ballet dancers, figure skaters, and gymnasts—athletes in sports with high rates of early specialization—have higher ages of menarche compared to non-athletes and ball sport athletes, which can have negative effects on long-term bone health (Kapczuk, 2017). Early specialization puts athletes at risk for overuse injuries due to high training volumes; according to the American Academy of Pediatrics Council on Sports Medicine and Fitness, at least 50% of athletic injuries are related to overuse (Brenner & Council on Sports Medicine and Fitness, 2016). Limiting a youth athlete’s weekly hours to train under their chronological age in years can help prevent overuse injuries.

The role of alter G running in the rehabilitation of stress fractures in female athletes

Jillian Santer, PT, DPT; Eliza Dewart, PT, DPT

Dr. Santer, coordinator of the Running and Foot and Ankle Rehabilitation teams at the University of Rochester, and Dr. Dewart, collaborator on University of Rochester’s Alter G return to run protocol, discussed the stress fracture rehabilitation process. Stress fractures account for up to 20% of all sports medicine injuries and occur due to repetitive submaximal strain on bone causing material fatigue and microarchitectural discontinuities (Fredericon, Jennings, Beaulieu, & Matheson, 2006). Female athletes are at higher risk for stress fractures than males and, in NCAA athletes, more stress fractures are sustained in the preseason than competitive season (Rizzone, Ackerman, Roos, Dompier, & Kerr, 2017; Wentz, Liu, Haymes, & Ilich, 2011). Once a stress fracture is diagnosed, the site of injury needs to be unloaded or immobilized. In normal running, the extremity in stance phase is exposed to 3-4 times the force of normal body weight with each step. Anti-gravity (alter G) treadmills allow for reduction in this force by unweighting the athlete by up to 20% of their body weight. Additionally, alter G treadmills can reduce gait abnormalities that are associated with weight bearing. Research suggests that the alter G treadmills are a useful treatment modality for stress injuries and support a quicker return to competition (Tenforde, Moreno, & Fredericon, 2012). Prior to initiating alter G running, the patient needs to be pain free at rest, walking without support, and completing activities of daily living. Typically, a rehabilitating athlete will run on the alter G three times per week, not on consecutive days, and completing rehab exercises on the same day as running.

Performing arts medicine: The hypermobile performing artist athlete

Bridge Quinn, MD; Andrea Stracciolini, MD; Ellen Gemini rainy, MD

Drs. Quinn, Stracciolini, and Gemini rainy, sports medicine physicians at Boston Children’s Hospital, discussed medical considerations for the hypermobile, female, performing artist, athlete. Joint hypermobility (JH) presents along a spectrum from asymptomatic JH to Ehlers Danlos Syndrome. Research examining hypermobility in dancers is scarce, but suggests that dancers have a greater incidence of hypermobility (Grahame & Jenkins, 1972). Hypermobility in the performing artist athlete can help the athlete more easily reach extreme positions, but also likely increases the risk of injury. Clinicians, teachers, and coaches can help the hypermobile athlete by encouraging training of endurance, balance, and proprioception, emphasizing quality over quantity, and adapting training as needed. The hip joint is a common location of injury for dancers, and a systematic review from 2017 determined that 17.2% of musculoskeletal injuries in dancers involved the hip and groin (Trentacosta, Sugimoto, & Micheli, 2017). Hypermobility impairs joint stability and can lead to increased load and demand on stabilizing structures in the hip joint. Using ultrasound for the hip in performing artist athletes allows for characterization of joint morphology, assessment of impingement and stability, and increased specificity when used alongside diagnostic injections.

The masters female athlete

Constance Lebrun, MDCM, MPE, CCFP (SEM), Dip. Sport Med, FACSM

1976 Olympian and sports medicine physician at the Glen Sather Sports Medicine Clinic with experience on the Canadian Medical Team for seven Olympic Games, Dr. Lebrun, discussed the current status of research on the physiological and mental status of female masters athletes. Physical activity in older age has many health benefits, including increased HDL, lower waist-hip ratios, higher bone mineral density, and fewer depressive symptoms (Douk, James, Henderson, & Price, 1997; Galper, Trivedi, Barlow, Dunn, & Kampert, 2006). Master’s athletes find success in a variety of sports, including athletics, swimming, and endurance events. The aging body undergoes physiological changes including loss of bone mineral density, sarcopenia, pelvic floor dysfunction, metabolism changes and VO2 max decline (Ben Kibler & Putukian, 2010). Bone density loss can be mitigated by a number of factors including weight-bearing activity. A cross-sectional study of active adults over 50 years of age found a strong correlation between bone density and moderate, but not extremely vigorous, weight-bearing exercise (Michel, Bloch, & Fries, 1989). Master’s athletes additionally exhibit better cognitive performance and a shallower decline in VO2 max than sedentary adults (Tseng et al., 2013).

The New Zealand WHISPER: Women’s Health in Sport: Performance Advantage Towards transdisciplinary research on female athlete health: The case of RED-S in elite sportswomen in New Zealand

Stacy T. Sims, PhD; Holly Thorpe, PhD; Sarah Beable, MD; Alison Heather, PhD

Drs. Sims, Thorpe, Beable, and Heather of the Women in Sport Aotearoa (WISPA) organization in New Zealand, presented their new research on female athletes. RED-S can have systemic and profound consequences for athletes (Mountjoy et al., 2014, 2018). Low energy availability is at the core of this model, and High Performance Sport New Zealand sought to understand if there is a relationship between the psychological and physiological changes, possible differences by sex, and biomarkers for at-risk individuals. Using a multidisciplinary approach, the project team utilized multi-methods data collection to examine demographics, training, energy availability, nutrition knowledge, resting metabolic rate (RMR), body composition, labs, and relationship with body, eating, and others. Female endurance athletes were found to have a higher percentage of low energy availability than rugby sevens, indicated by suppressed RMR, iron deficiency, and caloric deficit. Awareness of athletic and sport-specific culture,
as well as a multidisciplinary approach, supports prevention, awareness, and recovery from RED-S.

**Diet trends and athletes health: Unintended consequences?**

Nancy Clark, MS, RD, CSSD; Lynn Cialdella-Kam, PhD, MBA, RDN, CSSD, LD

Athletes follow diets for various reasons, including to support optimal health, to pursue body weight or composition goals, and for religious, social, environmental, or financial reasons (Cialdella-Kam, Kulpins, & Manore, 2016; Hinton, Sanford, Davidson, Yakushko, & Beck, 2004). Renowned Boston-based sports dietitian, Nancy Clark and former chair of the American College of Sports Medicine Nutrition Interest Group, Lynn Cialdella-Kam, discussed concerns related to recent dietary trends in the athlete population. Nutrient inadequacy in athletes is of concern due to the heightened risk of injury, hormonal disturbances, and immune suppression. Diets such as the Paleo diet, the gluten free diet, and the vegan diet, can be designed to provide adequate calories, but all of the diets fall short of at least one nutrient and have the potential to promote low energy availability. These diets also provide a high amount of fiber, which could cause gastrointestinal distress and impair the absorption of certain nutrients (Cialdella-Kam et al., 2016). Some athletes follow a special diet due to misinformation or as a way to restrict certain foods as part of a disordered eating/eating disorder behavior. Dietary intake that is “clean” can greatly limit nutrient and energy intake, as well as promote a negative relationship with food.

**Posters**

Eleven posters were accepted and presented at the 2019 FAC.

**The Culture and Consequences of Low Energy Availability in NCAA D1 Female Distance Runners: A Qualitative Investigation**

Traci Carson

*University of Michigan, Ann Arbor, Michigan, USA*

Qualitative methods were used to examine body image and dietary practices along with the psychological and physiological impact of low energy availability in female distance runners. Findings concluded that low energy availability is often co-occurring with internal pressure to have a “runner’s body”, comparison with competitors, and pressure from coaches.

**Relative Energy Deficiency in Sport (RED-S) in Elite and Pre-Elite Female Athletes**

Margot Anne Rogers, Nicole Vlahovich, David Hughes, David Pyne, Shona Halson, Greg Lovell, Renee Appaneal, Nic West, Bronwen Lundy, Marijke Welvaert, Louise Burke, Gordon Waddington, Micheal Drew

*Australian Institute of Sport, Canberra, AUS*

One hundred and twenty elite and pre-elite athletes in various sports (athletics, lightweight rowing, boxing, weightlifting, basketball, triathlon, water polo, and netball) were surveyed for hallmark indicators of RED-S using the Low Energy Availability in Females Questionnaire (LEAF-Q). The researchers found a high prevalence of these indicators and risk for low energy availability (n = 58; 55%) among the athletes surveyed, calling for the importance of screening and management protocols for RED-S.

**The Effect of the Menstrual Cycle on Running Economy**

Esther Goldsmith, Georgie Buinvels, Charlie Pedlar, and Mark Glaister

*St. Mary’s University, Twickenham, UK*

Researchers examined the effects of ovarian hormone fluctuations on running economy (RE) in ten eumenorrheic female athletes. Their results indicate that high levels of progesterone decrease RE, with the mid-luteal phase having the most significant effect. Goldsmith’s presentation won the 2019 FAC Poster Award.

**Awareness of the Female Athlete Triad in NCAA Cross Country Coaches**

Anna Warner, Katherine Rizzone, Scott Davis, Timothy Harvey, and Robert Chetlin

*University of Rochester Medical Center, Rochester, NY, USA and Baylor University, Waco, TX, USA*

NCAA cross country coaches’ awareness of the components of the Female Athlete Triad was assessed. One hundred and forty-three coaches from 45 conferences participated in the web-based survey. Results indicated that 82.1% of survey participants were familiar with the Triad and 54% correctly identified all three Triad components, leading the researchers to suggest that more should be done to increase NCAA coaches’ awareness of Triad.

**Retired Athletes and the Intersection of Food and Body: A Systematic Literature Review Exploring Compensatory Behaviours and Body Change (Buckley et al., 2019)**

Georgina Buckley

*Swinburne University, Melbourne, AUS*

Buckley presented her literature review of reports on retirement from sport and development of eating pathology and body dissatisfaction. The review of 16 studies found that changing body composition could lead to maladaptive eating and exercise behaviors and poor body image. More support needs to be provided to athletes in this transitory phase.

**Early Sport Specialization in Young Female Dancers: Preliminary Analysis**

Marina Gearhart, Dai Sugimoto, Bridget Quinn, and Andrea Stracciolini

*Boston Children’s Hospital Sports Medicine Division, Boston, MA, USA*

Researchers examined the health and performance of pre-professional female ballet dancers who met criteria for early sports specialization. Fifty-one female dancers from a prestigious ballet school in Boston completed the surveys and results suggest that specialized dancers were more likely to endure adverse health and performance consequences in comparison to the non-specialized cohort.

**Assessment of Concussion Symptoms in Female Semi-professional Tackle Football Players Between Two Consecutive Seasons**

Donna Duffy, Samantha Dubois, Christopher Rhea, Jennifer Etnier, and Victoria Blevins

*University of North Carolina at Greensboro, Greensboro, NC, USA*

Researchers examined changes in neurological functioning and concussion symptoms following head trauma in female tackle football players. This research group additionally explored female athletes’ motivation behind participating in competitive tackle football, a traditionally male sport. This study exploring the social construct of gender norms found that female tackle football players’ motivation to participate in their sport mirrors accepted motivators for sport participation and includes unique motives related to challenging gender socialization in sport.

**Exercise and Anorexia Nervosa Psychopathology**

Megan Kuhnle, Kendra Becker, and Elizabeth Lawson
Researchers compared the psychopathology of exercisers (> 5 hours per week) and non-exercisers with AN using the Eating Disorder Examination Questionnaire (EDE-Q). Analysis of results from four AN studies found that exercisers and non-exercisers did not have different EDE-Q global scores. However, among exercisers, there was a significant difference in the EDE-Q global scores relative to the number of hours of exercise per week.

**Gender and Demographic Factors Affect Adolescent Patient and Guardian Preferences for Sports Medicine Providers**

Melissa Christino, Jennifer Beck, Nicole West, and Nicholas Jackson

University of California Los Angeles, Los Angeles, CA, USA

Researchers explored whether adolescent patients and their guardians had gender and personality preferences for their sports medicine physicians. Survey results indicated that female patients were more likely to prefer female sports medicine physicians in comparison to male patients. Patients valued providers who were good listeners. This survey found that adolescent patients want to be involved in decision-making pertaining to their care.

**Sex: A Key Predictor for Complicated Symptom Resolution in Sport-originated Brain Injury**

Josh McGeown, Steve Kara, Hannah Crosswell, Robert Borotkanics, Patria Hume, Ken Quarrie, Alice Theadom, Mark Fulcher, and Natalie Hardaker

Auckland University of Technology, Auckland, NZ

Sports Performance Research Institute, New Zealand (SPRINZ), Auckland, NZ

Researchers examined the relationship between the clinical assessment of sport-originated brain injury (SOBI) and the ability to predict symptoms resolution within 14 days. This study also explored whether biological sex impacts this prediction of symptom resolution. Results indicated that those with higher SCAT-5 scores had more complicated recoveries and female athletes overall experienced more complicated recoveries from SOBI than male athletes.

**Summary of Evaluations**

Of the roughly 450 attendees, 177 provided feedback via an anonymous online survey following the conference. Of note, completing this survey was required in order to receive Continuing Education credits. Ninety-six percent of reviewers rated the conference as excellent or good and over 86% of attendees felt that the conference was above average (42%) or superior (44%) to similar courses. Presentations were rated highly; a majority of presentations were rated as excellent, with speakers who were knowledgeable in the subject matter and were well-prepared. Most felt that they would make clinical, teaching, or administrative changes as a result of this course, including screening female athletes for RED-S, incorporating collaborative care for the female athlete, and developing treatment plans and programming specifically for female athletes. Reviewers were also given the opportunity to provide written feedback and many expressed appreciation for the inspirational content and message, the inclusion of international speakers, and the networking opportunities.

**Looking Ahead: The 2021 Female Athlete Conference**

The 2021 FAC will be held June 10–12, 2021 and will be virtual. For more details, see www.femaleathleteconference.com.

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**References**


