

The Female Athlete – Sex Matters in Sports Medicine and Science

Weibliche Athleten – Das Geschlecht spielt eine Rolle in der Sportmedizin und -wissenschaft

Hélène de Pourtalès (1868-1945), was the first woman ever participating in the Olympic Games. In 1900 at the Games in Paris, she represented Switzerland in the sailing competition together with her husband, Hermann de Pourtalès, and her nephew, Bernard de Pourtalès. They won the gold medal in the 1 to 2 tons' boats class and Hélène became the first female Olympic Champion in history.

122 years later, it is nothing less than normality in most of our world's countries, that women have their own competition in every sports event, including disciplines that have long been a domain of men, such as soccer World Championships and Formula Racing. Every year the Laureus World Sports Award honors the most outstanding male and female individuals and teams. Although pay gaps and lesser media attention for female athletes are still unsolved issues in many countries and in international sports business, competitive sports have been a major driver of the ongoing political and societal development towards gender equality. Yet, by far most of the scientific evidence in sports medicine and training science has been derived from male populations, neglecting sex-specific differences in biomechanics, performance capacities and hormonal responses towards exercise stimuli. Search terms such as "menstrual cycle" AND ("exercise" OR "training" OR "sports") deliver only 1,027 hits in PubMed, thus not even half as much as "Christmas". Clearly, more research about the female athlete is necessary. In the most recent decades, scientists, physicians and medical doctors have started to investigate the exercising female organism and the body knowledge is growing. So does the experience from coaches and female athletes who started to adapt their training schedule to the menstrual cycle or adapted their strength training to the female anatomy clearly resulting in a decrease of overuse injuries.

The Menstrual Cycle and Trainability

The menstrual cycle has long been an embarrassing topic which no one openly talked about. However, an example of the importance of breaking with this taboo is given by increasing clinical evidence from recent studies. One example indicates that muscle stiffness may increase during the follicular phase, an observation relevant for injury risk and prevention in women (6). Another study found that in the

luteal phase, energy metabolism might rely more on fat than during the follicular phase (2). Considering variable physiological responses of the female body during the menstrual cycle might allow to restructure the athlete's training schedule and to achieve a better performance development and health promotion.

Anthropometry and Injury Risk

Differences in anthropometry, balance and range-of-motion between male and female soccer players have been identified (9), and might be related to injury risk (1). The risk of anterior cruciate ligament rupture is three times higher in female soccer players compared to their male peers (11). A dominance of the quadriceps muscle over the hamstrings has been proposed as a main cause, implicating intensive neuromuscular training of the latter as an important preventive measure (5).

Exercise Medicine in Women

Thinking of cardiovascular prevention, a sedentary and overweight man of advanced age comes to mind. Whereas middle-aged women have a lower risk for early myocardial infarction or stroke, post-menopausal women quickly catch up with their male peers. In example, flow-mediated vasodilation (FMD; a biomarker of macrovascular endothelial function) is equally reduced in older women and men 70 years of age and older (7). Also, FMD shows a greater reduction in very low-fit women compared to high-fit peers already in the fourth decade of life, thus about 15 to 20 years earlier than in men (8). These observations clearly indicate that cardiovascular prevention involving exercise training is a relevant concern of the aging woman.

Female Psychology

It is not surprising, that non-physical factors contributing to athletic stress interact in a different way in female athletes compared to their male peers. In a comparative study on Icelandic athletes, women scored higher on the Commitment Rating Scale (CRS) and on most items of The Motive to Achieve Success Scale (MAS) than men, possibly indicating a higher self-expectancy of success (3). Also, disordered eating and the harmful effects of social media affect females differently and at a higher rate than their male counterparts (4). A better >

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understanding of psychological differences between female and male athletes is, thus, necessary to sufficiently meet every athlete's specific needs for mental support.

Awareness of Coaches, Athletes and Other Stakeholders for Female-Specific Aspects in Sports

One of the most prominent health issues in female athletes is the relative energy deficiency syndrome (RED-S). Yet, awareness of RED-S among coaches remains low. Only 24% of high-school coaches have heard of REDS-S and only 14% can correctly name the top three symptoms (10). Despite extending the knowledge about the female athlete's body and mind, sports medicine and science has the responsibility to communicate this knowledge to the relevant stakeholders, such as coaches and the athletes themselves, and to actually improve the care of female athletes.

The current issue intends to raise the awareness about the specific needs in terms of optimal performance, better physical and psychological health care of female athletes. The presented topics include RED-S, the perception of coaches for sex-specific differences in the training of male and female athletes and the different adaptive responses of aerobic exercise stimuli in pre- and postmenopausal women. These are great examples of the female organism as a unique and highly complex system we are just beginning to understand. The female athlete deserves attention in sports and exercise medical research and practice. ■

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