Exercise and Sport Science Failing by Design in Understanding Female Athletes

In reflection on the numerous studies investigating differences in athletic performance and risk of injury in male and female athletes, I question whether a lack of control or consideration of physical capacity (eg, strength) or skill (eg, sport-specific or movement skill) potentially confounds much of this research. As a result, one or more variables that are modifiable through training (eg, strength, sporting, and movement skill) likely explain conclusions attributed to gender/sex.¹ Therefore, we should critically reevaluate the assumptions that are often made in the research design of gender-comparison studies to increase the underlying validity and avoid generalizations. In the exercise and sport sciences, such design improvements would include providing descriptive measures of participants to ensure that we do not perpetuate an ambiguous and potentially harmful conclusion that is overattributed to inherent gender differences. In the applied environment, removing this type of myopic lens is not only advantageous but necessary in our pursuit of improving performance and reducing injury risk. As experienced practitioners would attest, knowing the gender of the athlete provides much less information than knowing his or her training status (eg, no resistance training) or motor skills (eg, competent running mechanics). Then, why do we allow many studies to conclude something to the effect of “therefore females have different landing mechanics”? These conclusions fail to provide actual physiological or neuromechanical justification capable of broadening our understanding or extending our clinical practice, which should be the purpose of our applied scientific discipline. Furthermore, interpretations of results often fail to acknowledge the large magnitude of overlap in this dichotomous comparison that should have a more multifactorial conclusion than is currently acknowledged.²

Many researchers are seeking to ask more insightful questions to better understand female athletes and, in reality, all athletes. For example, investigators have questioned the underpinning reasons for purported gender-related differences: in sidestepping by highlighting the questionable clinical relevance of reported biomechanical differences,³ in neuromuscular research by using a strength-matched gender study design to question previously reported differences in hamstrings and quadriceps activity between the genders,⁴ and through critical review of gender in landing research, highlighting that differences between men and women are diminished, if not entirely removed, when skill increases.⁵ If the previously mentioned critiques are correct, the conclusions and subsequent messaging of potentially oversimplified gender comparisons may contribute to a persistent belief that female athletes are incapable or simply destined to injury or lower performance. Ironically, the perpetuation of such a message may lower belief in these athletes, a factor that has been shown to reduce the ability to learn and control motor skills in children⁶ and adults.⁷ Well-designed studies that seek to understand the influence of gender on athletic performance need to consider a multidisciplinary approach to describing or matching male and female participant groups by including basic physiological measures of strength and better descriptions of sporting age or skill

(eg, years at highest competition level or sport-specific skill) and athletic training age or skill (eg, years of resistance training or measure of movement skill). This is a much stronger approach to elucidating whether observed differences are a function of a modifiable trait versus that attributable to gender.

Our research continues to suggest and use language which assumes that modifiable variables are inherent to female athletes. Instead, the research should be highlighting the modifiable variables of lower strength and motor and sporting skill; not doing so indicates a sporting system (and society) that has failed to provide equal funding, opportunity, and qualified personnel. Despite our best efforts, removal of the stereotypes that threaten the motor skill development of our female athletes remains a problem. Furthermore, the assumption that coaching is the only influence on the attainment of motor skill is naïve and fails to recognize the development of motor skill before becoming “an athlete” and the daily influence society has on our athletes (from a very young age), independent of the training environment that may influence motor learning. Consequently, correct conclusions and messaging from the research that inform the messaging adopted by society are crucial. Lower motor skill attainment not only affects sport-specific skill but may subsequently reduce the transfer of improved strength to a skillful movement. Although strength and neuromuscular adaptations to resistance training are broadly similar in men and women,⁸ it could be hypothesized that if belief is not present the subsequent ability to learn to use this strength for a transfer to performance⁹ may not occur as readily in female athletes. Our approach to participant recruitment in many gender-difference studies has created a scenario where we attribute a vast amount of explained variance to binary categorization of male and female by assuming that random or convenience sampling is satisfactory despite the fact that is unlikely such an approach would provide participants with comparable normalized strength, years of movement, or sporting-skill training. As such, undoubtedly well-intended research on female athletes, through lack of control or description of modifiable factors such as strength, skill, and training age, has mostly perpetuated conclusions that overly prescribe the idea of female athletes’ having an inherent “issue.” It is a broad brush that does a disservice to not only our science but also the athletes we seek to support. Our conclusions and use of language are powerful and need to be considered in the design and interpretation of our research studies of female athletes.

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Note

I. Research in exercise and sport science uses the terms *gender* and *sex*. For this editorial, the term *gender* was used in alignment with the International Olympic Committee concerning gender identification and sport participation. Future research should consider the suggested term *gender/sex*, because gender and sex have been considered nearly

inseparable in neuropsychology and therefore it is difficult to purely assess biological sex differences that have implications for motor behavior.

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