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BIOLOGY, SPORT, TOP STORIES

Published on April 5, 2019

Sex Differences, Gender, and Competitive Sport

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Sport often presents us with striking visual examples of how certain aspects of society play out. Whether it be nationalism, leadership, teamwork, competitiveness, or the ability of humans to achieve truly great acts, sport is an embodiment of how these factors interact and display themselves on a world stage. Sport also offers some of the most obvious visual representations of inherent biological sex differences between men and women. Unfortunately, although perhaps not surprisingly, the current desire for equality and inclusion, and the general misunderstandings about biological sex as an evolutionary process has resulted in questions and confusion around the traditional use of sex categories in sport. In some ways this also highlights the difficulties that may be apparent with the erosion of sex categories in other areas of life, such as regarding prisons, changing areas and the issues of equal pay.

As a performance scientist and someone who has worked in elite sport for over a decade, I am interested in the determinants of physical performance and how to manipulate and enhance these variables. Over my years working with athletes, I have become accustomed to observing the differences between the sexes and have extensively studied why these differences exist. It has therefore been baffling to me to see some of the discussions regarding why sex categories in sport exist and how to include trans-athletes. What we must understand is that there is currently a general lack of understanding regarding the potential consequences on elite sport due to ill-informed policy making and the pressures of activist groups. I will therefore attempt to bring some clarity to the topic and also ask some important questions for future consideration.

Let us first briefly look at what sport is. Sport is a multi-billion dollar industry, with intense competition, professionalism and outstanding feats of natural ability. Athletes,

coaches and owners do everything they can to get an advantage over their competition and be successful. For many, the pure competition of sport is enough, regardless of earnings and sponsorship. For others it is their career, their life, their dreams. Yet for some it is a mere past-time, a leisure activity and a way to keep fit. None of these are inherently more important than the other, but recent debate over trans inclusion in sport means that we must appreciate what these things mean to the people involved and what is at stake if we get policies wrong.

Traditionally, sport has been split into male and female categories. This is based on biological sex differences and not necessarily what could be interpreted as gender. Competition has thus played out within these categories, with relatively large differences in outcome being observed between men and women (see Table 1.). Far from being products of socialisation and environment, these differences have been recorded across sports, cultures and generations. The table below demonstrates the world records achieved in male and female events and the percent differences between them.

Table 1. Differences between Male and Female World Records

Event	Male Record	Female Record	Difference	% Difference
100 metres	9.58	10.49	0.91	9%
200 metres	19.19	21.34	2.15	10%
400 metres	43.03	47.60	4.57	10%
800 metres	1:40.91	1:53.28	12.37	11%
1,500 metres	3:26.00	3:50.07	24.07	10%

Event	Male Record	Female Record	Difference	% Difference
5,000 metres	12:37.35	14:11.15	1:33	11%
10,000 metres	26:17.53	29:17.45	3:00	10%
Marathon	2:00:25	2:15:25	15:00	11%
High jump	2.45 m	2.09 m	0.36 m	17%
Long jump	8.95 m	7.52 m	1.43 m	19%
Triple Jump	18.29 m	15.50 m	2.79 m	18%
Pole vault	6.16 m	5.06 m	1.1 m	21%

These results alone should give a solid rationale for why there should be separate sex categories in sport, to allow for fair competition. Confirming this is the fact that within male competition, the world's best performances by different individuals often fall within 1 percent of each other, sometimes even within 0.1 percent. The same is true of female competition. These results are also mirrored across other sports, such as within cycling and swimming. This clearly demonstrates that there is not a continuum of performance results between the biological sexes, rather the results are bimodal, and the average female and the average male differ substantially. To be clear, this is not a moral argument, or an attempt to justify any one individual being treated differently to another, it is simply a review of the empirical evidence and a rationale for why the different categories exist.

It could be argued that even within a given sex there are large differences between individuals, and you may well see substantial differences between ages or races. While

this may be true, how far down the intersectionalist mindset do you have to go until you are happy that competition can take place between equal individuals? It is simply not possible, since by definition any single person is an individual, with their own unique characteristics and differences. Even within separate age brackets and races, there are large differences between individuals in terms of physical characteristics and prerequisites to performance. Trying to determine what these categories are and who qualifies for what is a nightmare not worth considering. In this respect, sport proves to be a devastating blow to intersectionalism and its limitations.

In fairness to the discussion on differences however, the actual observed variance between races is far smaller than that observed between male and female categories and may only be realized at the very pinnacle of elite sport, such as the 100m final where 100 percent of the champions in the past 30 years have been from West African heritage. However, the top results observed from other races fall within a much narrower bracket around these top results than the results from the opposite sex.

There have been many arguments over the years that the differences observed between men and women in sports performance are due to socialization and environment.¹ This blank-slate ideology of human beings appears somewhat naïve to the facts of sexual dimorphism present in all mammals. Despite our common tendencies towards egocentrism, surely, we don't believe that we are the only species that does not differ through sex?

To give a quick summary here so that we understand what we are discussing, sexual dimorphism is where males and females differ by more than just their sex organs. For example, in the mandrill (a species of Old World monkey that shares a common ancestor with humans approximately 25 million years ago), the male is 2-3 times heavier than the female. As Dawkins stated in his book *The Selfish Gene*, males and females, by definition, differ by the size of their "sex cells or gametes," and over evolutionary time, where there is an initial difference in gamete size, the effects of sexual selection appear to progress to maximize the specialities of the two sexes and it is then "possible to interpret all the other differences between the sexes as stemming from this one basic difference."

The effects of sex dimorphism within humans is pronounced in the physiology and anatomical structure that we see.² While there will always be the ignorant arguments that some women are taller than men, or some women are stronger than men, of course what we are talking about is on average. Or, more importantly with regards to sporting competition, the very best men compared to the very best women.

So, what are the physiological and anatomical differences between men and women that affect performance? One of the major contributors is the difference in muscular strength. Many studies across large samples from different cultures have found men to have 30–40 percent more muscle mass than females. The cross-sectional area of a muscle is highly correlated to the performance of physical tasks, since strength is a prerequisite physical quality. An analogy here would be to think of two pieces of rope. If both ropes are made of the same material, then thicker rope will be the stronger one. In addition to this, in skeletal muscle, the material (or muscle fibres) do actually differ. What we find is that males have a higher proportion of type II fibres, which are able to contract quicker and produce more force than their counterparts.³

Men and women also vary in the size and structure of the skeleton. Men have longer and thicker bones, with bone density being related to the ability to apply force and withstand injury.⁴ The corresponding shape of the skeleton and resulting biomechanics also mean that the female body is set up to produce less force in running, jumping and throwing.

All these characteristics contribute towards what can be termed muscular power. Power is often measured in studies of sports science, since power is highly related to success in sports performance. Simply put, the more power you can produce, the higher you can jump, the quicker you can accelerate, the harder you can kick and punch, and the further you can throw. What we find is that men can jump around 25 percent higher than women,⁵ can punch around 30 percent harder,⁶ accelerate around 20 percent faster, and throw around 25 percent further.⁷

And, it is also not just with regards to strength and power that we see sex differences. Men have larger lung capacity,⁸ greater cardiac output,⁹ and show greater resistance to injury.¹⁰

As a side note, to insure myself against the threat of being called a male supremacist, it is certainly not all good news for men. Men have a higher risk of heart attacks and type 2 diabetes, along with a whole host of other illnesses, which result in men dying on

average 4 years earlier than women. However, it would appear that the negative physiological aspects associated with being a biological male are sometimes ignored. So, we now know that there are many physical differences between males and females, which can't be explained only by society and environment. What is it then, that causes these differences? Well, one of the major contributors is the influence of testosterone, with large differences occurring throughout puberty.¹¹ But even before puberty, there are observed differences in many characteristics including body size and shape, and also in levels of aggression.¹² Indeed, it has been highlighted that over 3000 genes contribute just towards muscle differences between men and women. This combination of genetic components and hormones result in many factors each contributing towards the differences that are manifested in males and females. While the effects of testosterone supplementation or inhibition may go some way to modify the original characteristics, it is unlikely to reverse all of the sexually dimorphic manifestations.

Now, knowing the objective data, what does this mean for trans-athletes? The rise in LGBT rights and ideas of inclusion (which are noble aims) has somehow been confused with a misunderstanding of why categorization of athletes is necessary. There has perhaps been an assumption that because gender identity may be accepted as somewhat fluid, then biological sex must also be fluid. But someone's own perceived gender identity is not the same as biological sex. This is an example of someone's subjective feelings versus objective reality. And while a person is free to believe whatever they choose, their subjective feelings can never overrule empirical evidence.

It certainly may be apparent that many of the proponents of inclusion and participation are also the same people who dislike the idea of competition in general. Thus, for them the idea of not being allowed to participate in which ever category a person wants is terrible. But this is not what most people think about sport and certainly not at the elite level. For example, I would love to be a 100m world champion, yet my physiology would not allow it no matter how much I trained or how much I wanted it. But I don't feel excluded. We can't all be capable of doing every single thing in the world, and while we want to remove artificial barriers and enable opportunity and participation, we can't deny the facts of life.

This is not just about fairness in competition and the potential earnings at stake. While there are many females who make a living in professional sport, there is a perhaps an even larger danger. This could be apparent in boxing and combat sports, where the higher levels of strength and power could lead to devastating consequences. There may be cries here that I am being alarmist and looking at the worst outcomes possible, which are never really going to occur. But we can't possibly predict the future, and it is naïve to make decisions without thinking through all of the possible consequences. Indeed, some of the outcomes of this have already begun to play out. There may be some who say that we just accept it and move forward, but I don't think that is a forgone conclusion and it certainly requires some serious dialogue and sensible discussion at many levels.

So, what other options may there be? Do we abandon the categories of sex altogether? If we choose to believe that trans women are biological women (which the evidence would disagree with), then the gap between the current sports categories of men and women will cease to exist. A continuum of performance results will undoubtedly appear, so perhaps there is no need for separate sex categories at all? Well, I think it is clear what that would do to most of the women currently competing in professional sports. While this would also solve the problems of equal pay in sport, it would likely result in far fewer women actually being able to compete at the professional level.

So, if we decide not to abandon the sex categories, do we then add a third category of competition? This sounds like an okay solution, but there is certainly the worry here that this in itself would be classed as exclusion.

Another option would be to make the men's category an "open" category, where men and women (including trans) can choose to compete if they wish. While it is unlikely that many trans-athletes or women would compete at the top level in the "open" category, it is also the case that only a very small percentage of men are actually capable of competing at the top level anyway. But there would certainly be nothing to stop trans-athletes participating.

Whatever the answer is, it is not a simple one. While our ideologies and beliefs often distil complex problems into simple solutions and narratives, unfortunately the real world does not act that way. There are grey areas and ambiguities in all areas of life, and

it is essential to try and understand these and do the best we can in any situation. But inevitably, there are times when clear distinctions and boundaries need to be put in place to make society work and function. In these cases it is not possible to come up with a solution for every single problem instantly, but rather do the best we can with the evidence we have. While participation sport is something of a non-zero sum game, where it doesn't really matter who competes in what, since it is about the taking part, performance sport on the other hand, is a zero sum game. Performance sport is about competition, with large consequences in terms of finances, livelihoods and health. Legislation must be clear and precise and most of all it must be objective in nature. Personal feelings and ideas of inclusion are important, but we cannot hide from the facts.

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