Concussion in Sport: Gender Differences Highlighted by Results of Recent Study

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The issue of concussion in sport is frequently in the news at the moment. The risks and consequences of concussion have been highlighted in rugby, football, boxing and many other sports. However, the vast majority of these issues have been focussed on male participants.

However, a recent study available on the JAMA network, a free open access medical journal and funded in part by the Professional Footballers' Association (PFA) and the FA, has concluded that the risk of sports-related concussion (SRC) in female footballers is 1.88 times greater than their male counterparts.

The study considered injury data from 40,000 male and 40,000 female participants at the Michigan School Athletic Association. The data, gathered over three years and involving participants aged 14-18, indicates the need for concussion management to be sex-specific in this age group.

In addition, the study found that:

> *"whereas boys most often sustained SRC from player contact (48.4%), documented SRCs in girls were most often from equipment contact (eg, ball or goalpost [41.9%]), and boys had 1.54 greater odds of immediate removal from play and returned to play 2 days sooner than girls."*

The implications of the study are that the differing risks may necessitate gender specific approaches to both participation and concussion management in sport.

The study is not the first to note increased concussion risk in female athletes but highlights that the reasons for this increased risk remain unclear. Possible explanations may include a greater likelihood of symptom reporting in female athletes or, alternatively, physiological differences between male and female athletes contributing to concussion propensity. One suggestion is that female football athletes have lower neck strength and girth compared with male athletes and that cellular differences predispose them to greater risk of injury under dynamic stretch. Thus female athletes may be at greater risk of diffuse axonal injury, the principal pathology underlying concussion.

The implications of concussion in female sport have also further been reported upon in Australia where AFLW player Jacinda Barclay, who died last year, has become the first contact sportswoman in Australia to have her brain donated to the Australian Sports Brain Bank, where researchers have uncovered neurological damage that they described as a "ticking time bomb". All previous donations had been from male contact sport athletes – a pattern which is matched in much international research. Whilst a number of the male sportsmen were shown to have chronic traumatic encephalopathy (CTE), a neurodegenerative disease attributed to their playing careers, Miss Barclay did not but she did have degradation to her brain's white matter – rare for someone her age in peak physical condition. This type of degradation has been linked to mental illness.

Finally, it appears that significant further information is likely to be forthcoming with the introduction of specially designed mouthguards by the Leeds Rhinos rugby league side to monitor in game collisions. It is also reported that Manchester City FC and Liverpool FC have introduced similar monitoring for their women's and youth teams.

Prof Willie Stewart was the senior author of the study. He also led the research in 2019 which showed that former professional footballers were three and a half times more likely to die of dementia than the general population. He told MPs conducting a parliamentary inquiry into concussion in sport last month:

> "*We take the position that the only thing that connects football to American football to boxing to rugby to wrestling to other sports where we have seen this pathology is head impact and head injury exposure."*

> "*There must be something else because people can have exposure to head injury, people can play the sport the same way and don't develop problems, there must be other things contributing to it, but the one common factor is this head injury.*"

> "*To prove it beyond a reasonable doubt as opposed to on the balance of probabilities is a virtual impossibility, because the exposure is in their 20s and the outcome is 30, 40 years later. It is vanishingly difficult to prove beyond a reasonable doubt, but on the balance of probabilities I think we're there.*"

It is clear this is an area where the scientific knowledge is developing rapidly and where increasing international research into the area will lead to further developments. It is also now likely that female sport and the risks to female athletes will get further much-needed attention.