

## Chronic Traumatic Encephalopathy, and how to Prevent it

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Mammas, don't let your babies grow up to be rugby players. A recent research paper [1] found that after a single season, every last player in an un-named (Welsh) pro rugby team of test monkeys showed significant loss of brain function.

As the professional rugby season runs a mere 16 games, this makes the sport more acutely cognitively damaging than watching too much TV [2]. Depending on where you start from, a couple of playing seasons could bring your IQ down to game show host level.

Other studies of rugby playing gentlemen have generated broadly similar findings [3-5].

The trans-Atlantic equivalent is American football. This is a softer sport played in bursts lasting only a few seconds, totaling a mere 11 minutes of playing time per 3-hour game [6] and in which players wear protective helmets and copious padding. Despite this, as many as 1 in 8 former pro players suffer from cognitive decline [7] and although other life-style factors are clearly involved [8], high-impact collisions on the field are a major factor.

Some of those impacts are to the head. Football players account for about 2/3 of all cases of mild traumatic brain injury (anything from a bump to a concussion) recorded in USA school sport, with wrestling in 2<sup>nd</sup> place and oddly, girls' soccer in 3<sup>rd</sup> [9].

Only 6 concussions were reported in the University of South Wales study [1], however, so it is not just knocks to the noggin that do the damage. The researchers found that repeated clashes with other players, even if not directly to the head, were enough to cause impairment.

Any major hit sends shockwaves through the body, the spine, the skull and its contents. Although the brain rests in a shock-absorbing bath of CSF, the protective margins of this system are overwhelmed if sufficient kinetic energy is applied.

The Welsh research was initiated after a group of ex-rugby players sued the game's governing body after being diagnosed with early onset dementia [10]. As a former low-level rugby player myself - I played for 7 glorious school seasons, in roughly 300 games - I am very sympathetic to those affected. And I began to wonder why, well into my 7<sup>th</sup> decade, I still seem to be able to string a sentence together.

While some researchers have postulated that genetic risk factors are important in determining who acquires sports-related brain damage [11], the Wales results undermine that idea. I suspect that most of the problem originates in our industrial, pro-inflammatory diet.

The Welsh researchers found that by season's end, systemic oxidative-nitrosative stress (OXNOS) had increased in the players and NO bioavailability was down, together with reduced cerebral oxygen demand and delivery. OXNOS overlaps considerably with neuroinflam-

matory stress [12,13]. Both of these are drivers for depression [14], cognitive decline [14,15] and over the longer haul, neurodegenerative disease [16-19].

Now one can begin to see a mechanism linking high impact collisions on the sports field to cumulative brain damage. But one can also see how weaknesses in our metabolic defenses could be strengthened, and how pharmaco-nutritional armor might be considerably more valuable than body armor, which does not seem to protect NFL players any more than gloves protect boxers [20-22].

A number of food-derived compounds are known to reduce OXNOS and dampen inflammation. These are predominantly polyphenols [13], omega 3 HUFA's [16] and the prebiotic fibers [23]. Consumption of these protective compounds is dramatically reduced in the post-transitional ultra-processed diet [24-26]. This largely explains the explosive increase in the non-communicable degenerative diseases that dominate public health today and it is likely that the post-transitional diet also makes us more vulnerable to traumatic brain damage.

By restoring pre-transitional nutritional status in boxers and rugby players, their tendency to excessive inflammatory and oxidative-nitrosative damage would be reduced and their health prospects enhanced. This protective nutritional programming should ideally be instituted at an early age, because young players have more vulnerable brains [27-30].

But let us take a step back from the rough beasts of the rugby field and the boxing ring. The Welsh study is, I think, telling us something profound, and more widely applicable.

Humans were fired in the evolutionary crucible to be able to cope with a rough and tumble existence, and a supportive, pre-transitional diet was part of that. In our head-long rush to modernity we have been seduced by industrial foods. We have been weakened by them to the point where we are less able to withstand a hard knock life and contact sports have become more hazardous than they need to be.

As a utility player (wing, center and number 8) I picked up my fair share of hits and remember a few occasions when I was left disorientated for a minute or so. This was long before the age of ultra-processed foods, and as a Scot raised on a traditional diet of kippers, haggis, neeps, apples and oatmeal (omega 3's, polyphenols and prebiotics), I had a fundamentally anti-inflammatory and thus protective metabolism.

I also remember playing down in London in '67 and knocking out an annoyingly posh English player 'by accident', together with one of his teeth. I am not proud of this episode at all. If Nigel (genuinely) cares to contact me I will be happy to apologize, buy him a good whisky and reminisce over old times. At least, those times he can still remember.

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