



## Editorial

## Relevance by content and for methodological reasons: Neck Strength, Childhood Fitness and Maximal Lactate Steady State in Swimmers

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Three articles of the current JSAMS issue may warrant particular attention because they either investigate "hot topics" or give us methodological clues how to address particular research questions properly:

- Neck strength and concussion prevalence in football and rugby athletes (Shannon Nutt and colleagues)
- Longitudinal associations of childhood fitness and obesity profiles with midlife cognitive function: an Australian cohort study (Jamie L. Tait and colleagues)
- Comparison of different test protocols to determine maximal lactate steady state intensity in swimming (Sebastian Keller and colleagues)

The Nutt et al. study addresses neck strength and its relationship to sport-specific training and to concussion history. From measurements in a large cohort of young rugby ( $n=127$ ) and football (soccer,  $n=231$ ) players, it becomes clear that neck muscles mainly develop in parallel with training years and weight, i. e. an anthropometric correction takes away most of the differences between football and rugby players. Besides delivering something like "normative values", this study supports the superficial impression that the stature of rugby players differs vastly from that of football players in the sense that neck muscles are much better developed in the rugby players in parallel with their general muscularity. However, it is interesting that neck flexor-to-extensor strength ratio was associated with concussion history in male rugby players which may give rise to targeted training interventions aiming at head injury prevention. And this is important in the current discussion of how to prevent head injuries and/or to mitigate possible long-term consequences.

Tait<sup>2</sup> and colleagues present data from a "real" longitudinal approach, the Australian Childhood Determinants of Adult Health study over more than 30 years. Current discussions around shortcomings of the FIELD study (MacKay et al. 2019<sup>3</sup>; indicates a 3.5 times higher likelihood of dying from neurodegenerative diseases above the age of 70 in former Scottish football players compared to the general population) reflect how important such longitudinal cohort studies are. Based on their

inherent intra-individual follow-up, only they can provide a causal link between properties or activities in early life and later developments. Tait<sup>2</sup> and colleagues were able to demonstrate a relationship between better fitness in childhood and improved cognitive performance in mid-life.

Lactate thresholds have long been a domain of cyclists and runners although the duration of several swimming competitions (as well as associated metabolic processes) indicates that there may be an importance of thresholds for swimmers as well. The main reason for this shortcoming is likely the difficulty to obtain capillary blood samples from swimmers as easily as during cycle or treadmill exercise. From a physiological perspective, it is mainly the maximal lactate steady state (MLSS) which is of interest to coaches. Therefore, many threshold models try to approximate it. However, testing for equality - or at least similarity - between threshold intensities and MLSS is laborious and time-consuming. Keller<sup>4</sup> and colleagues took that burden and "validated" 4 threshold concepts in 23 swimmers of regional level. They demonstrated good correlations between thresholds and MLSS intensity (which is normal in such studies) and some interindividual variation in absolute deviation from the MLSS. Such studies cannot be replaced by simple correlational analyses between thresholds or between thresholds and competition results (which are much easier to conduct).

### References

1. Nutt S, McKay MJ, Gillies L et al. Neck strength and concussion prevalence in football and rugby athletes. *N Engl J Med* 2022;25:632-638.
2. Tait JL, Collyer TA, Gall SL et al. Longitudinal associations of childhood fitness and obesity profiles with midlife cognitive function: an Australian cohort study. *N Engl J Med* 2022;25:667-672.
3. Mackay DF, Russell ER, Stewart K et al. Neurodegenerative Disease Mortality among Former Professional Soccer Players. *N Engl J Med* 2019;381:1801-1808. doi:10.1056/NEJMoa1908483.
4. Keller S, Manunzio C, Wahl P. Comparison of different test protocols to determine maximal lactate steady state intensity in swimming. *N Engl J Med* 2022;25:696-701.