Don’t wait for the beep

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HIIT | Testing | Team Sport

Introduction

A race to the bottom: that is how the scramble by sports and teams therein to recruit young skilled athletes who show the potential to be successful as an adult can be described. These skills, often physical in nature, are assessed using protocols that many will be familiar with: jumping to measure strength and power in the lower limbs (1), maximal sprinting in series and isolation to measure repeated sprint ability (2) and speed (3), respectively and continuous and intermittent shuttle running to exhaustion for the quantification of aerobic endurance (4). In nearly all protocols reported within the literature and used amongst youth populations, the exercise intensity and/or recovery periods are externally regulated. Whether it be a repeated sprint test in which recovery periods are pre-defined or the YoYo intermittent running tests where running speeds and recovery intervals are controlled by an audio beep, athletes can, largely, complete the protocol without thinking.

Are there limitations to exercising without thinking?

Traditional assessments of physical capacity have taught us many things about the physiology of young people, within both athletic and non-athletic populations. They have helped us understand how growth and maturation affect factors such as oxygen uptake kinetics (5), high intensity running ability (6) and aerobic capacity (7), as well as establishing ‘norms’ which schools and parents can use to monitor the fitness of children. Furthermore, they have allowed sport to assess the effectiveness of organised programmes for talented athletes (4) and, also, identify those more likely to excel in certain disciplines (8). Given their widespread use, the reliability and validity of many assessments has been well established, facilitating the interpretation of resultant data (9). Whilst there is still a place for traditional, externally regulated assessment protocols, might there be circumstances where a model in which participants need to ‘think’ would be useful? In invasion sports, such as soccer, rugby, hockey and netball, players must not only exhibit the necessary fitness qualities to compete against their opposition, but also, decide when to use their physical attributes to greatest effect. Indeed, in adolescent soccer players, despite increasing chronological age resulting in improved maximal sprinting and aerobic speeds (6), the number of repeated sprint sequences during match play actually reduces (10). It could be argued that this is indicative of players developing a greater ‘game sense’ and an improved understanding of when such high intensity efforts are actually required. Although externally regulated protocols are reported to be ecologically valid (11), one may question the applicability of tests that do not demand a priori sports with non-uniform and unpredictable movement demands.

It is perhaps for this reason that traditional assessments of physical capacity, although able to differentiate athletes competing at different levels (4, 12), are less able to predict those more likely to be successful in a homogenous group. Those with experience of working with young athletes will invariably identify players who, despite modest scores in tests of physical capacity, are able to, subjectively at least, out-perform their peers during competition. It is worth exploring the possibility that protocols assessing the fitness of young people may be improved by incorporating a requirement to self-regulate exercise intensity and recovery. To use an analogy: traditional aerobic fitness endurance assessments used within team sports may reveal the ‘size of the engine’ a player has; however, they tell you little about ‘the driver’. A self-aware individual who knows how to make best use of their physiology might be preferable to another who does not, even if the latter is behind the wheel of a proverbial Ferrari. After all, the Tortoise won the race – not the Hare.

Self-regulated assessments of physical capacity

Amongst adult populations, self-regulated protocols using exercise intensities clamped to specific ratings of perceived exertion have been reported for the evaluation of VO2 max, albeit without agreement on their validity (13, 14). These tests, whilst involving a high degree of self-regulation, were continuous in nature with no requirement for participants to ‘select’ appropriate recovery periods as would be the case during intermittent exercise. When repeated sprint tests were performed on a cycle ergometer, power output was maintained to the same extent when externally regulated and self-selected recovery periods were used (15). These data, along with those of Glaister et al (16) suggest this may be an efficacious way of designing protocols to measure percentage decrement during intermittent exercise. The studies mentioned above, however, were all conducted in adults, so what about youth populations?

Two recent investigations have used repeated sprinting with self-selected recovery periods in youth populations (17, 18). The results revealed that although self-regulated recovery periods (as opposed to externally regulated and uniform between sprint intermissions) generally resulted in greater percentage decrements, some players’ performance improved when given autonomy over recovery duration. This would be easy to explain had those players whose performance improved selected longer recovery periods than were allocated in the externally controlled trial, however, they did not; their total recovery duration was shorter. So, some players recorded faster sprints and a lower percentage decrement whilst selecting shorter recovery periods; the implication being that pre-defined and externally regulated recovery periods hid the physiological capacity of these players, something sports and talent identification programmes might find concerning.

Any programme dealing with young athletes and interpreting measures of physical capacity would be wise to consider the impact of biological maturation on the results (19). Maturation has been reported to affect a number of physical qualities, including, repeated sprinting (20), high intensity running (21), sprinting (3) and movement characteristics during soccer match play (22). A recent study, however, reported that maturation may affect how able young athletes are to select appropriate between sprint recovery intermissions during repeated sprinting (18). Pre-peak height velocity players had a lower percentage decrement when externally regulated recovery periods were used compared to more physically mature counterparts (23). However, when self-regulated recovery periods were employed, post-peak height velocity players were better able to maintain their sprinting performance compared with
their less mature peers. It would appear this superior performance was achieved via the more mature players utilising longer recovery periods (2).

Future directions and opportunities
There is scope to develop our understanding of how young people perform in assessments that require the self-regulation of exercise intensity, recovery distribution and duration, that challenge facets of physical capacity other than repeated sprint ability. For example, how might performance in modified YoYo intermittent running tests, where participants choose their running speeds and between interval recovery intermissions, differ to traditional, externally controlled tests? Unpublished data from our group in youth soccer players reported likely faster peak speeds, possibly shorter total recovery and unclear differences in maximal heart rate during a self-regulated intermittent running test when compared to a YoYo Intermittent Recovery test. It was also apparent that participants had individual approaches to completing the self-regulated test, exhibiting markedly different and variable work to rest ratios. Further investigation may be warranted to determine whether this is reflective of playing position, maturation and/or higher order cognitive function (24, 25). The same could be said for the use of standardised work to rest periods in drills used to condition young football players. A recent study reported that when performing repeated sprints and high intensity running, movement characteristics were similar despite most likely differences in the speeds used in their prescription (26). Although the players were not able to select between-effort recovery periods in this study they were required to select running speeds that reflected the intensity prescribed. These data suggest that more work is required to investigate the fidelity of training programmes conducted in the field and that require young athletes to self-regulate running speed. In this sense, even when we ‘wait for the beep’ what athletes actually do and what we would like them to do may be separate entities.

Barriers to implementation
Perhaps the biggest barrier to applied practitioners implementing tests of this nature is the education required in order for youth participants to understand the aim of the test and the parameters under their control. Such parameters may include running speed and recovery duration/scheduling. Our experience suggests this is something that needs to be carefully explained beforehand and with clear guidelines displayed during the assessment. This is difficult to achieve with large groups and as such, practitioners may need to move toward performing tests with individuals in isolation to avoid the influence of their peers. Participants who see others taking less recovery or running faster may be inclined to follow suit. Individual assessments, at least in team sports, however, may be logistically difficult.

Aside from the practicalities of performing the tests, there would undoubtedly be a time lag between their implementation and a clear understanding of how the resultant data could be interpreted. Indeed, self-regulated intermittent running tests potentially provide a wide range of new metrics that are not easily interpreted. For example, what does optimal scheduling of efforts look like for a youth soccer player? Is there even an ‘optimal’ pattern and how might the feedback we provide affect performance? We are currently investigating the relationship between cognitive skills such as executive function and how young team sport athletes perform self-paced high-intensity intermittent running with different types of feedback. We acknowledge that coaches may be less willing to adopt such novel tests if it is unclear how this new information should affect their opinion of individuals in the short term and/or if it challenges established beliefs about which individuals are most able.

Conclusions
Fitness assessments are a well-established component of sport and education programmes for youth athletes, however, they traditionally involve exercise intensities and recovery periods that are externally controlled. Whilst this offers a reliable and valid means of assessing fitness, it removes the necessity apparent in training and competition, for those taking part to self-regulate exercise intensity and recovery intermissions. Self-regulated assessments of physical capacity may offer a useful means of addressing this gap. Data from self-regulated repeated sprint assessments in youth soccer, discussed herein, have highlighted some interesting findings regarding running performance and maturation. At present, more work is required to understand whether a similar approach would work for the assessment of aerobic capacity and the performance of high intensity intermittent running. With sports searching for new and improved methods of identifying and selecting talent, this may represent an attractive proposition, providing researchers, coaches and practitioners invest time in understanding the reliability of such protocols and generating new knowledge around how the resultant data should be interpreted. Whether we are ready to do away with the eponymous ‘beep’ remains to be seen.

References
1. Malone JJ, Murtagh CF, Morgane R, Burgess DJ, Morton VJ, Drust B. Countermeasures for new and improved methods of identifying and selecting talent, this may represent an attractive proposition, providing researchers, coaches and practitioners invest time in understanding the reliability of such protocols and generating new knowledge around how the resultant data should be interpreted. Whether we are ready to do away with the eponymous ‘beep’ remains to be seen.


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