Testing, prescribing and monitoring training in team sports: The efficiency and versatility of the 30-15 Intermittent Fitness Test.

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30-15$_{IFT}$ | Testing | Prescribing | Monitoring | Team Sport

Fig. 1. The 30-15$_{IFT}$ App -released in August 2018 and received more than 2000 downloads in its first week.

Headline

With limited time to implement comprehensive high-performance programs in team sports, we often hit roadblocks whereby ‘best practice’ is conceded to make the best of any given situation. These compromises are multi-factorial but commonly act as agonist to recalibrate what the priorities of the program are. Ultimately, this process allows you to investigate the inefficiencies of your program, resulting in a more streamlined approach going forward. However, it shouldn’t take roadblocks to search for more efficient methods within a high-performance program. Indeed, given how time poor many environments are, it is integral that we demonstrate the ability to think laterally and display versatility. This can be achieved by numerous approaches, however, the silent integration of testing, training prescription and monitoring methods can undoubtedly assist this process. The act of (a) utilising testing data to prescribe a more targeted training stimulus and (b) monitoring how athletes are responding to this training stimulus with less invasive measures, may be examples of how we can improve efficiency and create greater transparency across our systems.

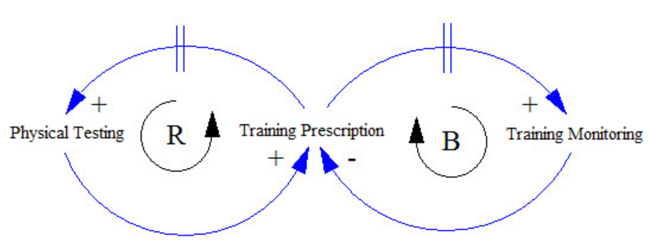

Fig. 2. The physical preparation feedback loop. Training prescription (training process) is reinforced (R) by the feedback from physical testing (training outcome) and balanced (B) by the positive and negative training status of the athlete (training monitoring).

Aim. The aim of this opinion piece is to highlight how these approaches can be imbedded within a high-performance program. Specifically, I’ll aim to demonstrate how utilising the 30-15 Intermittent Fitness Test (Figure 1; see 30-15$_{IFT}$) (1) (see 30-15ift.com for background information) can assist this process due to its versatility across performance strategies, providing examples of how this can be used for more than physical testing.

Background

To physically prepare athletes for team sport competition requires a fundamental understanding of the processes and outcomes of the training stimulus undertaken (2). Practitioners must correctly assess the training outcome (physical testing), manipulate training prescription (training process) and review the dose-response relationship (training monitoring) to optimise physiological adaptation and evaluate the program’s success. The interaction of these factors is inherently complex in team sports, due to multi-dimensional nature of training and divergent anatomical, physiological and functional responses to any given training stimulus across athletes.(2) However, the conceptual framework (or feedback loop) to this complex problem is rather simple (see Figure 2).

For this feedback loop to run effectively, it is required that all three elements are simultaneously integrated and consistently revaluated. Whilst the success of this is determined from many factors (i.e. validity and reliability of tests and variables analysed, strategies developed to implement change, communication between staff etc.), the streamlining of data collected within these systems can assist in the integration of these elements. Put bluntly, being more efficient and versatile with less data can help simplify strategies and assist in decision making.

Discussion

The process of simplifying strategies and integrating any central parameter within a high-performance program, like everything else has merits and limitations. From my experiences using the 30-15$_{IFT}$, this integration seemed rather organic in its progression. Importantly, it can deliver a clear rationale to why we test athletes and how we can provide meaningful changes within our program. Ultimately this is our aim, improve the quality of our program and provide strategies to create ‘meaningful’ outcomes. I firmly believe that the best high-performance programs have this as a clear focus. It’s great collecting huge amounts of data from testing results and monitoring systems, but if it's not being used or doesn't provide substantial upside, it's probable you could live without it. By doing so you may even get better buy-in with the other systems you have in place, clear some 'noise' around your program and consequently make better decisions. Remember, we are dealing with humans, a particularly complex organism that isn't necessarily more accurately identified and explained with more information. For this reason, keeping it simple is a rather nice concept. Hopefully these ideas may generate some discussion on how you can better integrate the testing, prescription and monitoring systems within your program more effectively.

Testing and Training Prescription. When aiming to individualise the training process for athletes, it is important that the training outcome guides and reinforces the training process (prescription).(3) Despite this, there is currently a lot of commentary circulating that we are too time poor for testing. I do agree with this, to an extent. We are too time poor for testing without meaning. If you aren't going to use your results to infer and drive your practice, stop. When done with purpose though, physical testing can provide more than just descriptive research. It can, and should, have a direct outcome or influence on your program. This creates 'buy-in' from players and coaches, through a transparent purpose. Ultimately, as physical performance coaches, we don't win competitions – players do – but we can erode the foundations of performance with poor physical preparation. Therefore, preparing athletes to be able to complete tactical and technical drills at the intensities coaches want, whereby their fitness isn't the limiting factor, should be our primary target. This is part of the reason I am a big advocate of the 30-15_{IFT}. From a testing tool, we can examine the ability of players to sustain high-intensity intermittent running,(4) providing a baseline for performance or identifying players who have 'truly' responded to the training stimulus prescribed (e.g. $\geq$ 0.5 km.h^{-1}; see Figure 3).(5, 6) In collision based sports were size is important, we can also track final momentum achieved during the 30-15_{IFT} (p_{IFT}: 30-15_{IFT} termination velocity (V_{IFT}) x body mass).(7) A measure that can assess the longitudinal interplay between size and fitness as we aim to concurrently develop these qualities.(8) But most importantly, this test provides a reference speed that has been shown to deliver homogeneous training responses,(1) providing a great template to help build these physiological foundations in a more targeted and systematic manner.

In many team sports, we are required to coach athletes with a wide range of physical and physiological attributes. For example, in rugby league, a front row forward may weigh up to 120 kg (V_{IFT} can be as poor as ≈16.5 km.h^{-1}) whilst the playmakers (halves) are typically 80 – 90 kg (and more likely to reach ≈20.0 km.h^{-1} or more). As such, it becomes problematic when aiming to design high-intensity interval training (HIIT) drills or sessions that deliver homogenous training responses across the squad. There has been much research(1, 9, 10) and 'applied' evidence (see Buchheit (11)) provided on the benefits and strategies of prescribing HIIT in team sports using the 30-15_{IFT}. However, much of this initial research has been developed in soccer or handball players, who typically present more homogenous physiological attributes than collision-based team sport athletes (e.g. rugby, American football). As such, when implementing these strategies, it is likely that heavier (mesomorphic) athletes may struggle with the set and rep schemes previously suggested (Figure 5). As a consequence, there is a need to extend these 30-15_{IFT}-based HIIT templates for collision-based team sports. Figure 6 presents an alternative strategy for these athletes. Despite employing typically shorter set durations, this template allows for the systematic progression of HIIT (and more intensive stimuli), whilst allowing athletes to better maintain targeted intensities and (hopefully) control running posture. Whilst this template shouldn't be implemented in isolation, it does deliver a stream of conditioning that may target more specific physiological functions whilst maintaining a level of uniformity across a large squad. It also provides an ongoing assessment of the training outcome, allowing us to progress players on, or move to harder V_{IFT} groups if required. This imparts more versatility within the program.

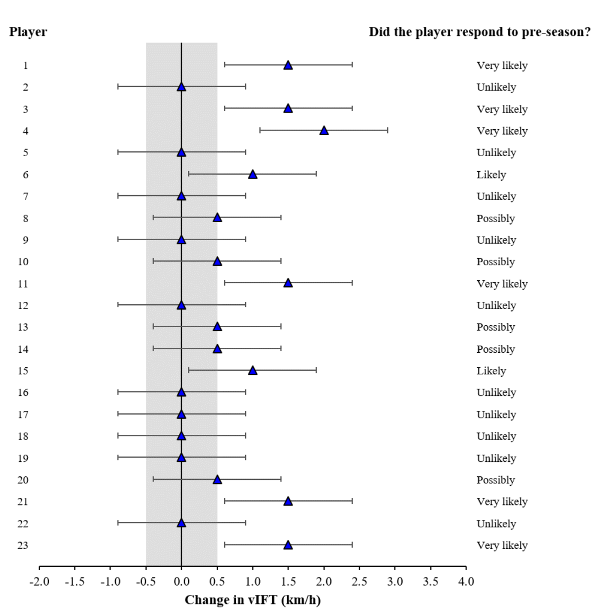

Fig. 3. Individual responses to the 30-15_{IFT} across a professional rugby league pre-season.

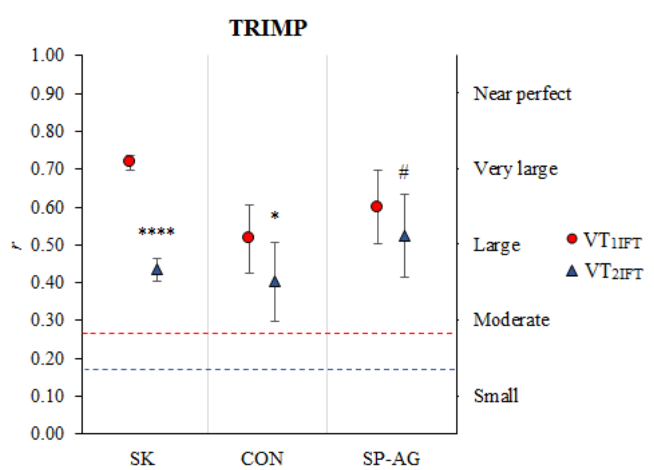

Fig. 4. Within-player relationships (r; 90% confidence intervals) of the distances covered above 30-15_{IFT}-derived relative speed thresholds with TRIMP. - *: possibly/ ****: almost certainly weaker ($\geq$ 0.10) than $VT1_{IFT}$. #: possibly the same as $VT1_{IFT}$. Red dash = pooled relationships between comparative arbitrary high-speed running distances and TRIMP from meta-analysis; Blue dash = pooled relationships between comparative arbitrary very high-speed running distances and TRIMP from meta-analysis(15) CON = conditioning; SK = skills; SP-AG = speed-agility; TRIMP = heart-rate-derived training impulse (Edwards); $VT1_{IFT}$ = distance covered at speeds $\geq$ 68% end-stage velocity achieved in the 30–15 Intermittent Fitness Test; $VT2_{IFT}$ = distance covered at speeds $\geq$ 87% end-stage velocity achieved in the 30–15 Intermittent Fitness Test.

Adaptations	Running time	Running intensity (%VIFT)	Recovery duration	Recovery intensity (% VIFT)	Running modality	Set length	Number of Sets	Recovery between Sets
Central	3 min	85-88%	-	-	Straight line	-	5 to 6	3'
	45 s	90%	15 s	Passive	Straight line	7'-8'	2 to 3	3'
	30 s	90%	15 s	passive	Straight line	7'-8'	2 to 3	3'
	30 s	90%	30 s	40%	Straight line	>12	2	3'
	30 s	93%	30 s	passive	Shuttle 40m	12'	2 to 3	3'
	15 s	100%	15 s	passive	Straight line	10'	2 to 3	3'
	15 s	95%	15 s	25%	Shuttle 40m	15'	2	3'
Peripheral	20 s	95%	20 s	passive	Straight line	7'-8'	2	6-7' active
	20 s	90%	20 s	45%	Shuttle 30m	7'-8'	2	6-7' active
	20 s	95%	15 s	passive	Shuttle 30m	7'-8'	2	6-7' active
	15 s	100%	15 s	passive	Shuttle 40m	7'-8'	2	6-7' active
	15 s	95%	15 s	25%	Straight line	7'	2	6-7' active
	15 s	95%	10 s	passive	Shuttle 40m	7'	2	6-7' active
	10 s	90%	10 s	passive	Shuttle 10m	6'	2	6-7' active
	10 s	95%	10 s	passive	Straight line	6'	2	6-7' active
	3 s	sprint	17 s	passive	20m sprint or 2 x 10m shuttle	6'	2	6-7' active

Fig. 5. Original V$_{IFT}$-based HIIT strategies developed by Buchheit(11)

Level	Progression	Running time	Running intensity (%VIFT)	Recovery duration	Recovery intensity (%VIFT)	Running modality	Repetitions	Sets	Recovery between Sets	Total Length
Level 1	1a	15 s	85%	15 s	Passive	40m Shuttle	6	2	2 min	8 min
Level 2	2a	20 s	90%	20 s	Passive	30m Shuttle	4	2	2 min	7 min 20s
	2b	30 s	85%	30 s	Passive	30m Shuttle	5	2	2 min	12 min
	2c	30 s	80%	30 s	Active (56% VIFT)	30m Shuttle	4	2	2 min	10 min
	2d	30 s	85%	30 s	Passive	30m Shuttle	4	2	2 min	10 min
	2e	30 s	85%	30 s	Active (60% VIFT)	30m Shuttle	4	2	2 min	10 min
	2f	30 s	90%	30 s	Passive	30m Shuttle	4	2	2 min	10 min
Level 3	3a	30 s	95%	30 s	Passive	30m Shuttle	3	2	2 min	8 min
	3b	30 s	80%	15 s	Passive	30m Shuttle	4	2	2 min	8 min
	3c	30 s	85%	15 s	Passive	30m Shuttle	4	2	2 min	8 min
	3d	30 s	85%	30 s	Passive	15m Shuttle	4	2	2 min	10 min
Level 4	4a	30 s	90%	15 s	Passive	30m Shuttle	4	2	2 min	8 min
	4b	15 s	105%	15 s	Passive	30m Shuttle	8	2	2 min	10 min
	4c	30 s	95%	15 s	Passive	30 m Shuttle	4	2	2 min	8 min

Fig. 6. V$_{IFT}$-based HIIT strategies for collision sport athletes.

Training Monitoring. Training monitoring systems are established on our understanding of the relationship between the training process and training outcome.(2) Once we feel comfortable that we have implemented some HIIT strategies that will progressively overload our athletes and induce positive adaptations, we are left with the million-dollar question. Is it working? Examining this training outcome and developing training monitoring systems can be achieved through many means, but our thinking should always be to first look at data currently collected. Indeed, much like prescribing training, training monitoring can be akin to opening Pandora's box. And much like conditioning, we can get far too clever and complicated. For this example, I'll demonstrate how the 30-15$_{IFT}$ can be used to better quantify the external load and evaluate athletes training status.

Whilst there are certainly benefits of utilising arbitrary speed thresholds to quantify external loads (individual and team longitudinal tracking, tactical performance metrics etc.) their physiological justification has been questioned.(12, 13) As such, relative speed thresholds expressed as an individual's first (VT$_{1IFT}$) and second (VT$_{2IFT}$) ventilatory threshold have been proposed as more appropriate alternatives.(12, 13) However, undertaking laboratory testing to determine these thresholds is impractical in most team sports. An alternative method to this may be to use estimated first and secondary ventilatory thresholds derived from the 30-15$_{IFT}$(14) [representing 68 and 87% V$_{IFT}$; modified from Buchheit(9)]. Recent internal research we've conducted demonstrates that these thresholds have a better relationship with measures of internal load, than that previously reported using comparative arbitrary velocities (from a meta-analysis; Figure 4).(15) As a result, we may get a more sensitive measure of external load through implementing thresholds we already have data for, providing a better understanding of the dose–response nature of training and competition.(16)

Once content with the derivation of the external training load, the next question is to make sense of the fitness and fatigue conundrum. Figure 3, briefly displays how performance may be evaluated using the 30-15_{IFT}, but we can also implement less invasive measures to assess changes in fitness or fatigue more regularly. Recently, methods such as the training efficiency index (TEI) have been proposed as an alternative to maximal tests to quantify how athletes are responding to training load without any testing, demonstrating positive results.(17) Submaximal exercise tests are another viable option for monitoring an athlete's physiological capabilities and responses to training, providing an appropriate tool to monitor athletes training status.(18-20) In my opinion, standardising an external dose and investigating the internal response seems a logical way of identifying an athletes training status.(21) The issue with submaximal testing for mine, is it may be ill-directed or misunderstood. For example, what is our targeted submaximal load or response? Should we include an intermittent or continuous stimulus? Does this need to be relevant to the sport and how do we standardise this for each athlete?

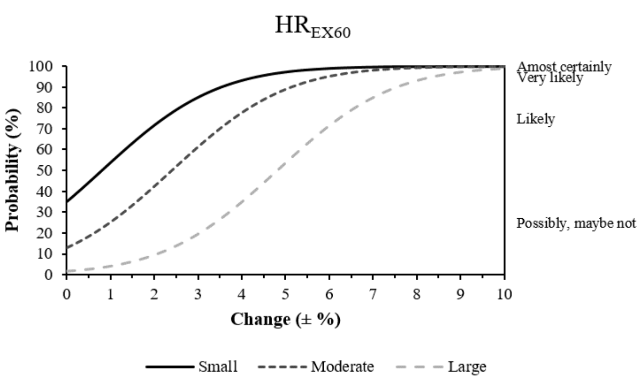

Fig. 7. A nomogram to interpret individual changes in a 4-min individualised submaximal shuttle run test in elite rugby league athletes. The x- and y-axes represent the observed change in the HR variable and the probability (% chances or likelihood category) that this change is greater than both the test-retest typical error and the chosen magnitude threshold (i.e. small, moderate or large, represented by different lines), respectively. $HREX_{60}$ represents the average heart rate over the last minute of the test, made relative to maximal heart rate.

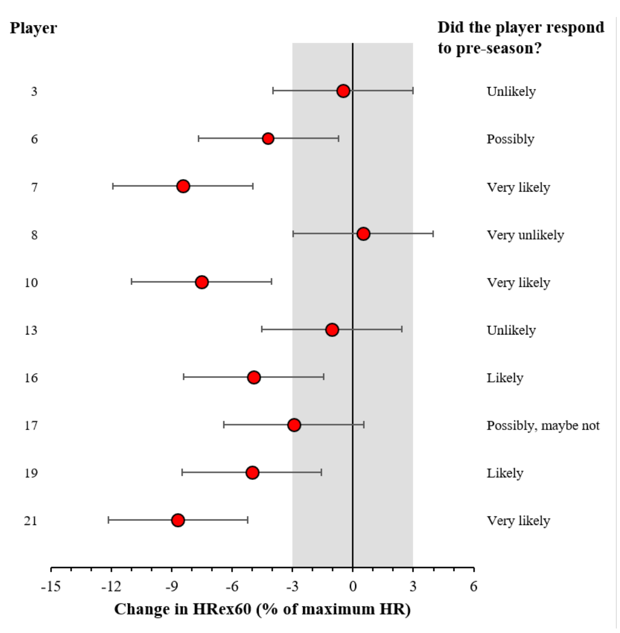

Fig. 8. Individual responses to individualised 30-15_{IFT}-derived submaximal shuttle run test (exercising heart rate average in the last 60 seconds).

When aiming to implement any training status assessment with a squad of athletes possessing heterogenous physiological attributes, these questions maybe legitimate obstacles. An answer to this may be to simplify our process and individualise submaximal testing using data we already have. In this situation, the 30-15_{IFT} can provide a standardised external dose across the squad (similar to HIIT) at submaximal intensities. From internal unpublished data, it appears using a 4-minute continuous submaximal shuttle test (12 x 20 second shuttles), prescribed at 60% V_{IFT}, may be an optimal load to answer many of these questions. Indeed, it appears more reliable than both a 12 km.h-1 continuous run and Yo-Yo Intermittent Recovery Test Level 1 (both lasting 4 minutes). From this test, we can identify 'true' responses by accounting for both the change required to be considered substantial and the test TE (responder: change > nominated threshold and TE; see Figure 7) across varying heart rate variables. Importantly, from an applied perspective, monitoring this over the course of pre- and in-season we have been able to make actionable changes and infer levels of fatigue (Figure 8). Taken together, this analysis may provide another versatile avenue to use your 30-15_{IFT} data, allowing more outcomes and insights to feed back into your high-performance framework.

Summary

It is vital within any high-performance program that we understand what our priorities are in order diminish inadequacies and implement meaningful changes. As such, improving the efficiency of your methods to test, prescribe and monitor training will likely help focus and direct performance strategies. For this reason, testing isn't simply something done at the start and end of pre-season through a maximal physical test. It is something that can be done on-going (through the assessment of the training outcome) and should positively affect the outcomes to your program. A decision tree of sorts, allowing for adjustments to the training process. In the framework described above, the 30-15_{IFT} is used as an example of how a central parameter can be used to implement greater homogeneity across large squads. However, we must understand the limitations of this process and where it fits in with the bigger picture. For example, whilst this allows for a more tailored conditioning program, I should mention, there are certainly times where a homogenous training outcome shouldn't be a goal. After all, once you cross that white line everyone must get the job done. Further, HIIT and conditioning in general needs to be multi-dimensional, aiming to achieve not only physical but psychosocial adaptation too. Lastly, there are other methods (such as the TEI) that exist as promising alternatives to assess the training status of athletes. However, in the cost-benefit analysis washup I believe applying the versatility of the 30-15_{IFT} across a performance program can allow for greater transparency, consistency and overall maintain some simplicity in your methods.

Acknowledgments. It would be remiss of me not to mention those people who have helped shape these philosophies and data presented. Those in the Brisbane Broncos performance team (Jeremy Hickmans, Ryan Whitley, Blake Duncan and Dave Ballard), my PhD supervisors (Grant Duthie, Ben Dascombe and Colin Sanctuary) who suggested and guided a lot of this research as well as Shaun McLaren for his help analysing much of our data.

Dataset

Dataset available on SportPerfSci.com

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