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METABOLIC CONDITIONING: FIELD TESTS TO DETERMINE A TRAINING VELOCITY

ABSTRACT

To effectively develop physical parameters, training intensities should be individualized to suit an athlete's current fitness level, for example percentage of 1 repetition maximum in strength and power development. In regards to anaerobic or aerobic conditioning, a velocity prescription can be both accurate and effective in individualizing energy system development. However, there is a sparsity of research available comparing the range of tests capable of determining an appropriate velocity. The following review discusses the optimum way to determine an individual's desired training velocity through field based testing.

INTRODUCTION

Athletes require a range of highly developed physical abilities such as strength, power, aerobic and anaerobic conditioning (28, 33). For optimal development of these parameters, training intensities should be individualized to suit each athlete's ability. Generalized training prescription where an individual's working intensity is too low, or too high, may cause no adaptation or lead to over-training (38). It is reported that the use of a training velocity can be both accurate and highly effective during aerobic and anaerobic fitness development (13, 16). While information regarding the implementation of a training velocity is widely available (6, 9, 16, 18, 27, 28, 54), there is a sparsity of research available comparing the range of tests capable of determining an appropriate velocity.

Accurate assessment of an individual's aerobic or anaerobic function may be optimal during laboratory conditions. Procedures will often produce a measure that relates to a specific physiological state; for example, velocity at lactate or ventilatory thresholds and velocity at $\dot{V}o_2$max (v$\dot{V}o_2$max) (11). v$\dot{V}o_2$max is defined as the lowest running velocity that elicits maximal oxygen uptake during a continuous exercise test (12). By considering the test outcome as a velocity, rather than a physiological marker such as $\dot{V}o_2$max, future training can include individualized prescription and within session monitoring. For example, a session prescribed at an intensity of 100% $\dot{V}o_2$max is not easily applied due to the difficulties of measuring the desired work; however, a session prescribed at 100% v$\dot{V}o_2$max has much easier application due to the distance and time prescription. For example, an interval session may be designed with a training intensity of 120% v$\dot{V}$o2max for 15 seconds work and 15 seconds passive rest, repeated for 5 minutes and 2 sets. While the consideration of lactate thresholds or directly measured $\dot{V}o_2$max may be beneficial, the majority of practitioners may not have access to the facilities, budget, or time required for such testing. However, single procedure field-based tests are available for indirect determination of a range of physiological states. Due to the ranges in physiological demand during field tests, it is more appropriate to term the velocities produced as maximum running speeds (MRS) rather than $v\dot{V}o_2max$. When comparing tests and their recorded MRS, the protocol utilized determines the overall physiological stress and subsequently the measured physiological state. For example, intermittent tests are likely to have the greatest anaerobic energy contribution and be suited to supramaximal (above $v\dot{V}o_2max$) training sessions prescription. In comparison, continuous versions may be more aerobic dominant and suited to submaximal (at or below $v\dot{V}o_2max$) training prescription. The following sections will outline protocols and validity considerations for a range of tests capable of producing a MRS for either submaximal or supramaximal training prescription. Both of these styles of training may be implemented in a range of sports dependent on the goals of a training program and the athlete's strengths and weakness. Traditionally the selection of a field test is based upon the ability to match the physiological stress during competition, however, not all available tests are capable of producing a MRS. Therefore, the following tests will be discussed in relation to their ability to produce a MRS capable of influencing future programming.

DETERMINING A RUNNING SPEED FOR SUBMAXIMAL TRAINING

Time/Distance Trials

The 12-min Cooper Run (23) is a continuous field test where performance is significantly correlated to a treadmill based $\dot{V}o_2max$ (46). The Cooper Run utilizes a linear running protocol where the athlete must 'self-pace' their intensity in order to cover the greatest possible distance (23). A time trial over 5km is also significantly correlated to treadmill based $\dot{V}o_2max$ (50) which supports the use of either a 'time' or 'distance' based protocol. The required duration of a time trial depends on the time required to elicit maximal aerobic contribution with reduced anaerobic participation. It has been reported that the time required to maximally stress the aerobic system and test v$\dot{V}o_2$max is 4m 58s (22), with the average time to exhaustion at v$\dot{V}o_2$max ranging from 4-8 min (12, 34). Furthermore, significant correlations are reported between v$\dot{V}o_2$max, the average velocity during a 5-min time trial (v5TT) (10) and a 1,500m trial (40). Therefore, the use of a traditional 12-minute Cooper Run may be unnecessary as the same physiological state can be measured with more time efficiency.

While various forms of time trial or distance based tests may produce valid and reliable estimates of v$\dot{V}o_2$max, the testing style may require a developed pacing strategy (developed through familiarization) for optimum performance (51). The time trial protocol however, does benefit from being able to be performed with many exercise ergometers where distance can be easily recorded or set. The continuous linear determination of a MRS may be best suited to training styles of a similar nature and subsequently sports such track events and rowing. However, this training style may also be suitable for individuals with low training ages and low aerobic fitness levels. Ease of application to ergometers also provides a wide range of possibilities for contraindicated athletes, which may provide useful for contact sports with high injury prevalence.

The University of Montreal Track Test

The University of Montreal Track Test (UMTT) is a reliable and valid field test used to determine $\dot{V}o_2$max (41). The velocity achieved in the UMTT (vUMTT) provides an estimated v$\dot{V}o_2$max as accurately as a laboratory based treadmill measurement (40). The high level of accuracy in determining $\dot{V}o_2$max may be aided by the pre-recorded incremental velocity, removing variation caused by self-pacing. However, although highly accurate, it is also reported that $v\dot{V}o_2max$ directly measured in a laboratory is likely to be slightly lower (1.2%; $0.07 m{\bullet}s^{-1}$) than vUMTT (12, 40). It is possible the testing protocols (table 2) may cause this discrepancy, as each stage during the UMTT lasts 2-minutes (8, 29) in comparison, to treadmill based $v\dot{V}o_2max$ protocols, where stages may last up to 4 minutes and include inclination (30). The UMTT protocol may also allow a slight increase in the contribution of the anaerobic energy system due to test completion and MRS being calculated once full exhaustion and drop out has occurred (41). The test has previously been used in sports such as soccer (29) although the test may be suitable for all sports reliant on aerobic endurance which may utilize a continuous linear training style.

The 20m Shuttle Run Test

The 20m shuttle run test (20SRT) (43) is a continuous, incremental velocity shuttle test designed to predict $\dot{V}o_2max$ (43). The 20SRT has repeatedly been utilized by sports such as squash (52) and soccer (3) as well as with recreationally active children and adults (42, 49). The initial protocol utilizing 2 min stages was (43) was adapted to utilize 1 min stages due to the time taken to reach $v\dot{V}o_2max$ (42). This protocol was subsequently re-validated to again predict laboratory measured $\dot{V}o_2max$ in both children and adults (42, 49) while continuing to show reliability across multiple trials (3). Since the initial adaptation in protocol, it seems that this version has become more commonly utilized due to its selection in a range of studies (47, 49, 52).

During the 20SRT, MRS is determined from the final stage (v20SRT), although variation may exist between individuals whom finish on the same stage as each stage contains multiple shuttles. However, it has been reported that validity did not change when test performance was considered final velocity rather than total distance covered (46). The 20SRT often under predicts an individual's $\dot{V}o_2max$ (8), particularly in trained athletes. This may be due to the 20m shuttle demand resulting in an increasingly disturbed running rhythm at higher velocities, hindering full aerobic contribution. Shuttle speeds are lower compared to linear ones due to the time required decelerating and re-accelerating (2, 43). Due to the discrepancy found between shuttle and linear testing, the v20SRT must be converted for use with linear training styles using a previously developed regression equation (7). As this conversion would still act as an estimate, the 20m protocol may not be suited to athletes with high fitness levels and it may be concluded this test is a poor choice for session individualization regardless of sport.

Table 1: Test protocols for submaximal training prescription

Test	Style	Protocol	Starting Speed	Velocity Increments	Final Velocity Determination
Time Trial	Linear	Continuous Linear Running. As fast or as far as possible	Self-Paced		Average velocity of test: distance (m) / time (s)
UMTT (41)	Linear and Incremental	Markers are placed around a running track at 50m intervals Pre-recorded beeps control participants speeds The end of the test occurs when the individual is more than 5m behind a marker on two consecutive stages	8km·hr^{-1}	1km.hr^{-1} every 2 minutes.	Velocity of the last completed stage
20SRT (43)	Shuttle-based and Incremental	Participants complete a 20m shuttle Speeds controlled by a pre-recorded beep The end of the test is concluded when a subject is unable to match the pace set by the recording and was more than 3m short of the shuttle line on three consecutive attempts	8km.hr^{-1}	1km·hr^{-1} every 2-minutes (43) 0.5km·hr^{-1} every 1-minute (42)	Velocity of final stage reached

DETERMINING A RUNNING SPEED FOR SUPRAMAXIMAL TRAINING

Anaerobic Speed Reserve

The anaerobic speed reserve is considered to be the difference between an individual's maximal sprinting speed and their $v\dot{V}o_2max$ (13, 20, 24). Having a higher anaerobic speed reserve decreases the relative intensity (percentage of anaerobic speed reserve) of exercise above $v\dot{V}o_2max$, lowering anaerobic energy contribution and peripheral fatigue (20, 53). For comparison and sporting examples, see athlete A vs athlete B in table 2. Supporting this, time to exhaustion at intensities above $v\dot{V}o_2max$ are shown to have a stronger relationship with the anaerobic speed reserve than with $v\dot{V}o_2max$ (13), as anaerobic speed reserve takes individual anaerobic work capacity into account.

However, during repeated performance at intensities close to maximal sprinting speed, a larger anaerobic speed reserve (if due to a lower $v\dot{V}o_2max$) would be considered a negative aspect of performance. For example, it has been reported that an increased anaerobic speed reserve is positively correlated to fatigue index during repeated sprint cycling (45). Likely due to a lower $v\dot{V}o_2max$ meaning aerobic energy production is unable to sufficiently support the recovery process between efforts causing and a rapid onset of fatigue. For comparison and sporting examples, see athlete C vs athlete D in table 2. It has also been reported that anaerobic speed reserve alone is unable to predict improvements in mean repeated-sprint time (19), due to the independent change of $v\dot{V}o_2max$ and maximal sprinting speed and their effect on the anaerobic speed reserve calculation. Therefore, although training individualized by $v\dot{V}o_2max$ plus a percentage of anaerobic speed reserve may be useful for anaerobic fitness development; anaerobic speed reserve scores must not be compared between individuals or considered in relation to performance without $v\dot{V}o_2max$ and maximal sprinting speed being analyzed independently.

Table 2: The relationship between the anaerobic speed reserve and performance

Athlete	vVo_2max	Maximal Sprinting Speed	Anaerobic Speed Reserve	Exercise Intensity	Physiological Response	Example Sporting Application
A	6m·s^{-1}	11m·s^{-1}	5m·s^{-1}	8m·s^{-1}	Lower anaerobic energy contribution due to a higher anaerobic speed reserve compared to athlete B. Therefore greater time to exhaustion, less fatigue and improved performance.	Compared to athlete B, this profile may be of benefit during continuous exercise with intensities just above vVo_2max. For example, a scrum half in Rugby or a Centre Midfielder in Soccer.
B	6m·s^{-1}	9m·s^{-1}	3m·s^{-1}	8m·s^{-1}	Greater anaerobic energy contribution compared to athlete A. Therefore faster time to exhaustion, greater fatigue and lower levels of performance.	
C	5m·s^{-1}	10m·s^{-1}	5m·s^{-1}	9m·s^{-1}	Lower anaerobic energy contribution due to a smaller anaerobic speed reserve compared to athlete D. Therefore greater time to exhaustion, less fatigue and improved performance.	Compared to athlete D, this profile may be of greater benefit during maximal exercise. For example, a winger in Rugby or Soccer.
D	4m·s^{-1}	10m·s^{-1}	6m·s^{-1}	9m·s^{-1}	Greater anaerobic energy contribution compared to athlete C. Therefore faster time to exhaustion, greater fatigue and lower levels of performance.	

Yo-Yo Intermittent Recovery Tests

The Yo-Yo Intermittent Recovery tests (YYIRT) have been designed to evaluate team sport player's ability to repeatedly perform and recover between intermittent exercise (4) (protocol available in table 3). The test is designed with a 'Level 1' (YYIRT1) and a 'Level 2' (YYIRT2) suitable for individuals with lower and higher fitness levels respectively (4). Two versions of a Yo-Yo Intermittent Endurance test are also available; however, due to a scarcity of research these testing variations have not been further discussed.

The YYIRT1 has been shown to be repeatable across multiple trials (36), with the total distance covered significantly correlated to $\dot{V}O_2max$ (29, 36, 48). However, large inter-individual differences are also observed, for example, participants with very similar $\dot{V}O_2max$ showed a difference in completed distance of 640m (36). Therefore the estimation of $\dot{V}O_2max$ from YYIRT1 performance lacks accuracy. This variations in performance is likely due to the contribution of the anaerobic energy system and the intra-set recovery period during the shuttle-based protocol (5). Supporting this, blood lactate (La^+) accumulation has been found to be higher during YYIRT1 than during a treadmill based $\dot{V}O_2max$ (36). Subsequently, the physiological state reached is considered supramaximal of $\dot{V}O_2max$. Irrespective of the inclusion of a 10 sec rest period, the protocol still suffers from an increasingly disturbed running rhythm at higher velocities associated with a 20m shuttle distance (32). This is reported to result in varied test performances between individuals with different fitness levels (36). The YYIRT2 remains repeatable (31, 37), but utilizes a higher starting speed to allow for a shorter test completion time and greater suitability for highly trained athletes (4). This results in an increased contribution of the anaerobic energy system (5), supported by the tests lower relationship with $\dot{V}O_2max$ (31, 37).

Establishing a MRS for these tests has been completed by utilizing the speed reached on the final completed stage (21) or a previously developed equation (39) utilized alongside the YYIRT1 (29). The use of velocity at the final stage may suffer from the same issues discussed within the 20SRT where athletes reach the same stage but complete a different number of shuttles. In contrast, the mentioned equation may provide a near perfect relationship between distance covered and MRS as completed shuttles is considered (39). While the use of the Yo-Yo based tests to determine a MRS may be questionable, the tests are commonly utilized during intermittent team sports such as football due to its greater sensitivity in detecting changes in performance compared to $\dot{V}O_2max$ (35).

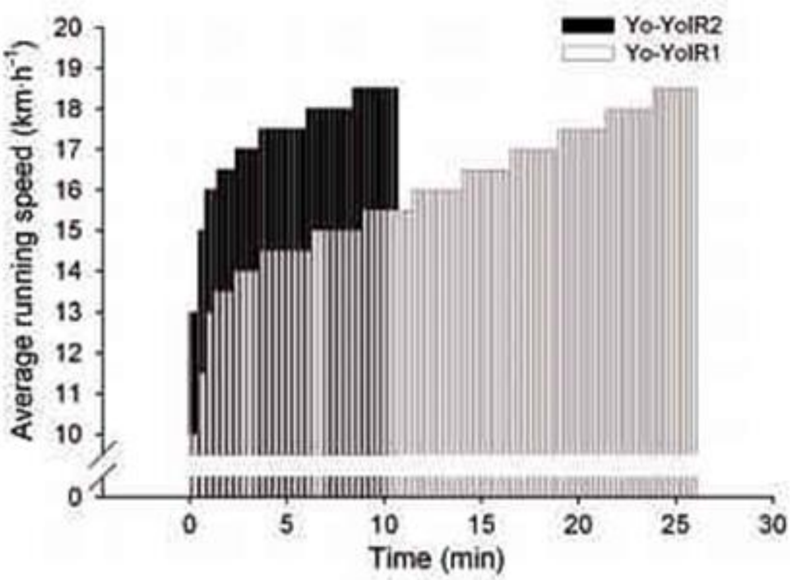

Figure 1: Schematic representation of velocity progressions for the YYIRT Level 1 and Level 2 (48).

The 30-15 Intermittent Fitness Test

The 30-15 intermittent fitness test (30-15IFT) was designed (15, 16) in order to provide reliable estimations of sports specific fitness for athletes involved with multi-directional, intermittent team sports such as Soccer, Rugby and Handball (14). The final velocity reached (vIFT) is significantly correlated to $\dot{V}o_2max$, counter-movement jump height and 10m sprint speed (16). The intermittent, time based protocol was designed with 30s work as this allows enough time for cardiorespiratory kinetics to adapt to the exercise intensity (25) and sufficient oxygen consumption to occur (44). Furthermore, 15s recovery may allow for sufficient but incomplete restoration of energy substrates such as phosphocreatine (26). The 40m shuttle distance is thought to aid in reducing blood lactate levels compared to the more common 20m shuttles (36). Protocol characteristics such as these are all thought to help contribute to a supramaximal MRS (16).

Due to the influence of change of direction ability on shuttle speeds, a value of 0.7 sec is subtracted from the running period for each change of direction (16). For example, a speed of 11.5km·hr^{-1} would mean linearly covering 96m in 30 sec, although when utilizing a 40 m shuttle requiring 2 x direction changes (2 x 0.7sec), running distances is reduced to 91.6 m (11.5km·hr^{-1} in 28.6 sec) (16). This conversion helps the 30-15IFT provide a valid and reliable measure of multidirectional sprint performance (16). The provided vIFT also enables players with different physiological profiles to achieve a similar level of cardiorespiratory demand during training (16). Making the test highly suitable for individualizing supramaximal conditioning in multidirectional intermittent sports such as Soccer, Basketball and Rugby (16).

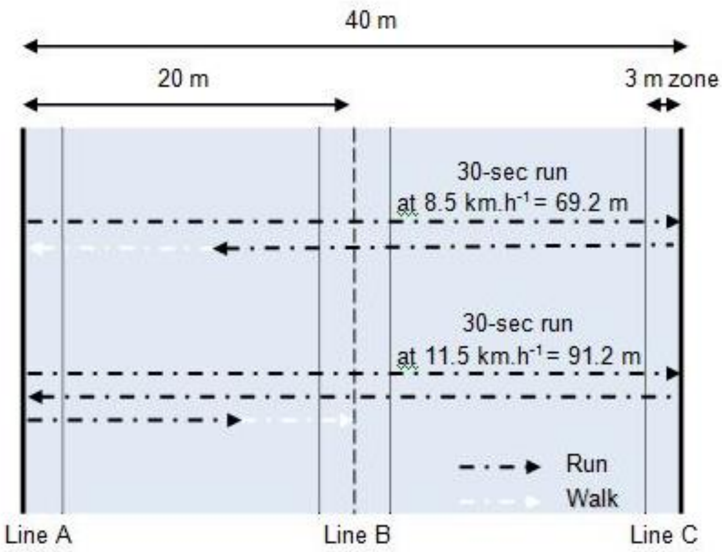

Figure 2: A testing area prepared for the 30-15IFT with two example shuttle stages (16).

Table 3: Test protocols for supramaximal training prescription

Test	Protocol	Starting Speed	Velocity Increments	Shuttle Distance	Recovery Time	Final Velocity Determination
YYIRTL1 (5)	Participants complete 2 x 20m shuttles followed by 2 x 5m active rest during allocated recovery time. Pre-recorded tape required	10km hr^{-1}	See figure 1.	20m	10s	Either the velocity reached at the final completed stage or through use of equation 1.
YYIRTL2 (5)		13km hr^{-1}				
30-15IFT (16)	30s shuttle within a 40m area (with a midline at 20m) Each line has a 3m zone (either side of the midline) See figure 2. Shuttles followed by a 15s active rest period when the participants walk in a forward direction to the nearest line. A pre-recorded tape is needed to signify the time required to reach each line followed by a beep representing the end of a 30s stage.	8km hr^{-1}	Increasing by 0.5km hr^{-1} after each 45 second stage	40m	15s	vIFT is established when the individual is unable to reach the 3m zone of the correct line after 3 consecutive shuttles

Table 4: Test reliability and reported relationship with $v\dot{V}o_2max$/ $\dot{V}o_2max$

Test	Relationship with $v\dot{V}o_2max$/ $\dot{V}o_2max$	Reliability	Participants
Time Trial	5min Time Trial ($r = 0.94$; $P < 0.001$) (10)		N = 48 men (27.9 ± 6.9 yrs; $\dot{V}o_2max$ 55.6 ± 8.2ml.kg.min^{-1})
UMTT	vUMTT compared to $v\dot{V}o_2max$ ($r = 0.97$, SEE = 1.92ml.kg.min-1) (40) $\dot{V}o_2max$ predicted via UMTT compared to direct treadmill based measurement ($r = 0.96$, SEE = 2.81ml.kg.min^{-1}) (41)	r = 0.97, SEE = .55 mets –. Similar results regardless of age or performance level (41)	N = 9 male and 1 female (mean $\dot{V}o_2max$ 61.4 ± 10.9 and 61.5 ± 10.6ml.kg.min^{-1} for treadmill and UMTT respectively) (41) N = 32 Highly trained runners (mean $\dot{V}o_2max$ 70.1 ± 5.5ml.kg.min^{-1}) (40)
20SRT	20SRT distance covered compared to $\dot{V}o_2max$ ($r = 0.71$; SEE 5.9ml.kg.min^{-1}; $r = 0.90$; SEE 4.7ml.kg.min^{-1}) for children and adults respectively (42) v20SRT compared to $\dot{V}o_2max$ (r=0.90, p<0.05) (49)	$r = 0.97$; $p < 0.01$; CV = 2.2% (3)	N = 188 children (8 – 19yrs) and N = 77 adults (18-50 yrs) (42) N = 36 physically active men and 38 physically active women, ($\dot{V}o_2max$ men 58.5 ± 7.0 ml.kg.min^{-1}, women 47.4 ± 6.1ml.kg.min^{-1}) (49) N = 12 male soccer players, ($\dot{V}o_2max$ 54.6 ± 4.2ml.kg.min^{-1}) (3)
YYIRTL1	Distance covered compared to $\dot{V}o_2max$ ($r = 0.74$, $P < 0.05$; $r = 0.71$, $P < 0.05$; $r = 0.61$, $P < 0.05$) (29, 36, 48). High inter-individual differences found within groups.	R = 0.98; CV = 4.9% (36) ICC = 0.78, CV = 7.3% (31)	N = 13 professional ($\dot{V}o_2max$ 58.5 ± 3.8 ml.kg.min^{-1}) and 12 amateur ($\dot{V}o_2max$ 56.3 ± 4.3 ml.kg.min^{-1}) soccer players (48) N = 13 male subjects (36) N = 14 amateur male soccer players ($\dot{V}o_2max$ 60.1 ± 6.5ml.kg.min^{-1}) (29)
YYIRTL2	Distance compared to $\dot{V}o_2max$ ($r = 0.56$, $P < 0.05$ (37)	ICC = 0.93, CV = 7.1% (31) CV = 9.6% (37).	N = 24 junior soccer players (17 ± 1 years) (31) N = 13 healthy males and N = 119 male elite soccer players (37)
30-15IFT	vIFT compared to $\dot{V}o_2max$ ($r = 0.68$, p<0.05) (16) Significantly higher than $v\dot{V}o_2max$ (18.2 ± 1.6 vs. 14.1 ± 0.9km/h^{-1} respectively; p<0.001) (16)	ICC = 0.96 (14)	N = 59 youth athletes (16.2 ± 2.3 years, $\dot{V}o_2max$ 45.8 ± 5.8ml.kg.min^{-1}) (16)

INTER-TEST COMPARISON

As previously stated, intermittent tests are likely to have the greatest anaerobic energy contribution compared to continuous versions and are therefore more suited to supramaximal training intensities. Supramaximal tests (such as the 30-15IFT and YYIRT) unsurprising produce very different velocities as final MRS could be any proportion of the anaerobic speed reserve (above $v\dot{V}o_2max$). For example, the vIFT is consistently 20-25% faster than v$\dot{V}o_2$max (17) and approximately 15-25% higher than the vUMTT (17). Significantly higher blood lactate concentrations are also found during the 30-15IFT compared to the UMTT supporting a greater amount of anaerobic energy production (17). This relationship however, depends on the specific protocol utilized and can also be affected by individual fitness levels. For example, no significant difference is reported between YYIRTL1 performance, v$\dot{V}o_2$max (21) or vUMTT (29). However, when an individual's MRS was higher than 16.3km·hr^{-1} the vUMTT was frequently higher than that achieved in the vYYIRT1 (29). Concluding that the vUMTT and the vYYIRT1 are more suited for athletes with a greater and lower v$\dot{V}o_2$max levels respectively (29). This variation in performance is likely due to aspects discussed earlier such as increasing running rhythm disruption during 20m shuttle distances and a short or non-existent rest period resulting in a lack of phosphocreatine (PCr) resynthesis or lactate clearance (26). It may be these issues which contribute to the v20SRT being lower than that found in the 12-min Cooper run (46) and the vUMTT (1).

When comparing the velocities produced during submaximal, aerobic dominant tests such as a 5min Time Trial and UMTT, less variation is present due to the protocols attempting to represent a similar physiological demand. For example, the UMTT is strongly correlated to the results found during the 12min Cooper run (41), the v5TT and a treadmill based $\dot{V}o_2$max test (10). However, when analyzing scores in more detail, the vUMTT was 1.1km·hr^{-1} faster than the v5TT and approximately 1.4km·hr^{-1} faster than the treadmill v$\dot{V}o_2$max (10). Interestingly, individuals with greater anaerobic speed reserve present greater differences between vUMTT and v$\dot{V}o_2$max (41). This variation may be due to the 'sprint finish' method used in incremental tests that utilize the final reached velocity as a MRS as those with a greater anaerobic speed reserve may have a greater 'burst' of speed during the final stage.

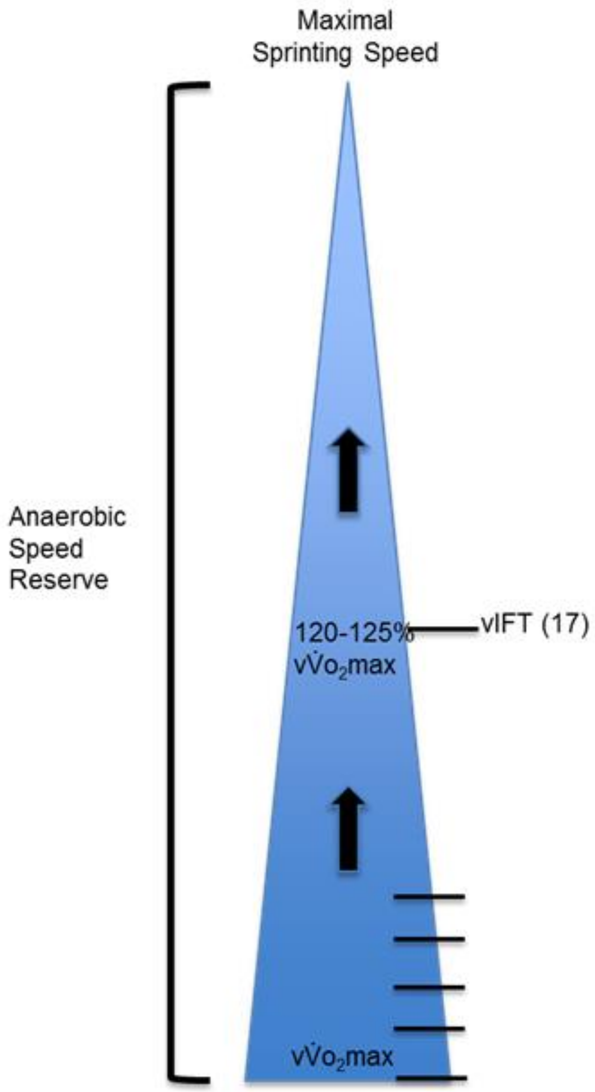

Figure 3: Approximate intensity range utilized for various field based tests. Adapted with permission from (17)

CONCLUSIONS AND PRACTICAL RECOMENDATIONS

When selecting a test to support training prescription, it is important to consider desired training style, sporting application and logistical testing characteristics. Firstly, the desired training style should be established based upon sport, individual training age and periodization. Tests should then be compared based upon their ability to produce a reliable MRS and their validity in measuring a desired physiological state (table 4). Subsequently, shuttle tests such as the 20SRT and the

YYIRT's may be the least suited to training individualization. This is due to a lack of reliable MRS determination and high variations in inter-athlete physiological demand. Therefore individualizing supramaximal, multidirectional and intermittent training should be completed using the 30-15IFT due to its greater programming accuracy (16, 18). This is most likely to be suited to team sports such as Handball, Basketball, Rugby and Soccer.

In order to individualize linear, submaximal, continuous training such as that used in track based running or as preparation for supramaximal training; a test must be selected based upon its aerobic dominant protocol and relationship to $v\dot{V}o_2max$. Therefore, dependent upon the logistical constraints of testing procedures (such as space requirements) either a Time Trial or the UMTT should be utilized. These tests are associated with easy velocity determination and are suitable for athletes of various fitness levels. Furthermore, the use of a 5min Time Trial (or distance of similar duration) allows the most time efficient testing and the use of various ergometers for greater conditioning variation. If the option of a supramaximal, linear training style is desired, accuracy may improve via the use of a percentage of anaerobic speed reserve, which requires the initial determination of $v\dot{V}o_2max$ (via a continuous linear method) and maximal sprinting speed.

Table 5: Recommended tests for training individualization

Training Intensity	Training Style	Recommended Test	Considerations	Example Sporting Application
Submaximal	Linear	5min Time Trial	Familiarization may be required due to the influence of a pacing strategy Space requirements	For use with continuous sports such as distance running and rowing. Also suitable for other sporting athletes with low levels of aerobic fitness whom may utilize continuous or interval based submaximal linear training.
		University of Montreal Track Test	Space requirements	
Supramaximal	Linear	5min Time Trial and the Anaerobic Speed Reserve	Space requirements Maximal Sprinting Speed must be established	For use with sports that require intermittent high anaerobic energy production. For example, wingers in Rugby and Soccer and shorter track running events.
	Shuttle	30-15 Intermittent Fitness Test	Pre-recorded tape	For use with multidirectional, intermittent team sports such as Handball, Basketball, Soccer and Rugby.

FIGURE/TABLE LEGEND

Figure 1: Schematic representation of velocity progressions for the YYIRT Level 1 and Level 2 (48).

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Table 2: The relationship between the anaerobic speed reserve and performance

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