COMPARISON OF A YOYO INTERMITTENT RECOVERY LEVEL 1 TEST AND A VO_{2max} TEST AS A DETERMINATION OF TRAINING SPEEDS AND EVALUATION OF AEROBIC POWER

[1,2]Nathan Heaney, [1]Morgan Williams, [1]Christian Lorenzen & [1]Justin Kemp
[1]School of Exercise Science, Australian Catholic University, Melbourne, Australia
[2]Victorian Institute of Sport, Melbourne, Australia

INTRODUCTION

Physical fitness tests can be effectively employed to evaluate an athlete's training status and from the measures obtained; utilised to prescribe and quantify training intensity. One component of physical fitness that underpins team sport activities is the aerobic energy system (8). Therefore, time spent training with a goal to improve or maintain this system is justified.

The 'gold standard' measure of aerobic fitness is maximal oxygen uptake (VO_{2max}). It can be obtained either directly from a laboratory based gas analyses, or more commonly and less accurately, indirectly using performance based field testing. Once VO_{2max} has been obtained, derivatives such as velocity at VO_{2max} (vVO_{2max}) can be used to prescribe the intensity for aerobic energy system conditioning (3).

vVO_{2max} can be defined as the minimal velocity associated with VO_{2max} determined by an incremental treadmill test (1). Alternatively, maximal aerobic speed (MAS) can be defined as the minimal speed that elicits maximal oxygen consumption (6) and can be obtained from field measures (UMTT, 20m SR & TT). Both vVO_{2max} and MAS are utilised to describe and quantify training intensity particularly with the prescription of high-intensity interval training. The application of high-intensity interval training using MAS or vVO_{2max} as the intensity measure for aerobic conditioning has been commonly utilised with middle and long distance runners with significant improvements in aerobic measures (1). However, these methods have not received the same attention within a team sports context.

Currently, a more novel approach emerging for determining training intensity is based on YOYO Intermittent Recovery tests (YOYO IR) (2). One potential limitation of utilising the YOYO IR1 to establish training intensity is the fact that it may not be sensitive enough when trying to establish individualised training speeds for training prescription. This is due to the fact that the speed of each level remains constant throughout all the shuttles. Kuipers et al (5), has identified this lack of sensitivity and proposed an equation [$V_{YOYO} = V + 0.5 \times (n/8)$] to address it.

Given that deriving training intensity from the YOYO IR1 is currently not well established, this study aims to demonstrate the relationship between the YOYO IR1 test and in state level netballers. In addition, by comparing the laboratory based to the field measures and investigating their relationship, it is anticipated that the efficacy of using final speed obtained from the YOYO IR1 test (YOYO MAS) to prescribe high-intensity interval training will be shown.

METHOD

Ten state institute netballers (age = 19.4 ± 2.5 years; stature = 182.4 ± 6cm; mass = 80.2 ± 14.8kg) who were injury free (7) participated in this study. All testing was performed during the pre-season.

Two testing sessions were completed.

1) YOYO IR1 tests were completed on a sprung floor at the VIS
2) VO_{2max} test was completed within a week of the YOYO IR1 re-test

YOYO IR1 testing protocol

Total distance in metres was recorded as the performance outcome and the speed at the last completed shuttle was recorded as maximal aerobic speed (YOYO MAS). The Kuipers equation was utilised and recorded as YOYO MAS Equation.

VO_{2max} testing protocol

Participants ran on a motorised treadmill commencing at 10kmh. For the first five minutes of the test 1kmh increments were utilised. Thereafter, 0.5kmh increments were used every minute until exhaustion.

1% gradient was used to reflect energy cost of running outdoors (4)

Statistical Analyses

- All data analyses were performed utilising SPSS version 15 for Windows (Chicago, Illinios).
- The appropriate data sets were tested for normality using the Shaprio-Wilk test and descriptive data reported.
- Pearson's correlation coefficient was used to test the relationship between variables.
- Curve estimates provided in the SPSS software (e.g., quadratic, power and exponential) were used to check that a linear relationship was the most suitable.
- When appropriate, linear regression models were applied and the standard error of estimate reported.

RESULTS

The participants (n = 10) recorded a mean YOYO IR1 score of 1432 ± 431m (min distance = 720m, max distance = 1880m) which equates to a level 17.1 (min level 14.7, max = 18.4).

The participants obtained a mean of 44.9 ± 5.7 ml.kg-$^{-1}$.min^{-1} (min = 36.5 ml·kg^{-1}·min^{-1}, max = 51.3 ml·kg^{-1}·min^{-1}) in the laboratory.

Table 1: Correlational analysis of the YOYO IR1 and VO2max test

		VO_{2max} (ml·kg^{-1}·min^{-1})	YOYO IR1 (m)
VO_{2max} (ml·kg^{-1}·min^{-1})	Pearson	1	.953*
	(2 tailed)		.000
	N	10	10
YOYO IR1 (m)	Pearson	.953*	1
	Sig (2 tailed)	.000	
	N	10	10

Table 2: Correlational analysis of training speeds

		vVO_{2max}	YOYO MAS	YOYO MAS Equation
vVO_{2max}	Pearson	1	.826*	.808*
	Sig (2 tailed)		.003	.005
	N	10	10	10
YOYO MAS	Pearson	.826*	1	.980*
	Sig (2 tailed)		.003	.000
	N	10	10	10
YOYO MAS Equation	Pearson	.808*	.980*	1
	Sig (2 tailed)		.003	.001
	N	10	10	10

Table 3: Training speeds obtained from the YOYO IR1 and the VO2max test

vVO_{2max} (m·s^{-1})	YOYO MAS (m·s^{-1})	YOYO MAS Equation (m·s^{-1})
4.26 ± 0.24	4.39 ± 0.20	4.46 ± 0.18

No agreement was found for MAS measures and VO2max

Regression using distance gave model (r2 = 0.665)
Y = 0.456 (Distance) + 3.617 ± 0.16 m/s

Multiple regression using distance and stature improved the model (r2 = 0.918)
Y = 0.701 (Distance) + 0.030 (stature) – 2.201 ± 0.08 m/s
Where: Distance (km) and stature (cm)

DISCUSSION

Both training speeds obtained from the YOYO IR1 (YOYO MAS and YOYO MAS Equation) tended to overestimate training intensity when compared to vVO_{2max}. Therefore, the direct derivatives of MAS from the YOYO IR1 can not be used interchangeably with vVO_{2max}.

Training intensity (vVO_{2max}) can be accurately predicted when the distance travelled in the YOYO IR1 and stature of the individual are used as independent variables in the regression model presented. The inclusion of the participant's stature may reflect the differences between the laboratory and field test used.

Therefore, the direct derivatives of MAS from the YOYO IR1 can not be used interchangeably with.

PRACTICAL APPLICATIONS

The YOYO IR1 test provides the strength and conditioning coach with a practical, time efficient and cost effective method of measuring physical capabilities of female netballers.

The test also offers an accurate estimate of training intensity (vVO_{2max}). From the differences found in this study, strength and conditioning coaches should be cautious using the YOYO MAS and YOYO MAS Equation to prescribe training intensity based on recommendations in the literature that have utilised vVO_{2max} to good effect.

The consequences of such erroneous use will result in athletes 'working' at a higher than anticipated training intensity. However, the accuracy in prediction of training intensity (vVO_{2max}) is improved by the use of the regression model presented.

Lastly, the findings of this study are unique as there is no other literature available looking at using MAS &/or vVO_{2max} determined from the YOYO IR1 with female netballers.

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