

The Reliability of a Team Sport-Specific Running Protocol on a Non-Motorised Treadmill



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Introduction

At present there are few testing methods that reliably evaluate performance of the work demands of team sports (3,7).

The purpose of this study was to report on the reliability of a new test and method for measuring team sport running performance on a non-motorised treadmill (NMT) in a laboratory.

Methods

Subjects

11 moderately-trained ($VO_2\max = 52.6 \pm 4.5 \text{ ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$; age = 23.6 ± 4.5 yrs; body mass = 77.5 ± 8.2 kg) male team sport athletes participated in this study.

Following a familiarisation session, each subject completed three 30 min team sport-specific running protocols on a NMT, separated by 6 days.

30 min Team Sport-Specific Running Protocol

The activity profile of the 30 min team sport-specific running protocol was based on previous time and motion studies of various team sports including soccer, rugby league and Australian rules football (2,6).

Two 15 min activity profiles were performed succinctly (separated by a 2 min rest) on a NMT (Force Tread Dynameter, Woodway, USA) to form a total duration of 30 min.

Included in these activity profiles were six running speeds: standing (0% of maximal sprint speed (MSS)), walking (20% MSS), jogging (35% MSS), running (45% MSS), fast running (65% MSS) and sprinting (100% MSS) (see figure 1).

The six movement categories were designated a particular duration based on time and motion data from team sports (2,6). Standing, walking and jogging were all assigned 8 s time durations. Running, fast running and sprinting were assigned 6 s, 4 s, and 3 s time durations, respectively.

A specialised software package (Force Software, Innervations Joondalup, Australia) then randomised the movement duration data into a 15 min set protocol such that the total amount of running at any given speed would approximate that which occurred during a competitive match (1).

The result was a 30 min team sport-specific running protocol, which comprised of 181 changes in speed (first 15 min period = 91 changes, second 15 min period = 90 changes).

Statistics

A one-way ANOVA was used to determine any significant differences in physiological and performance variables between the three trials (SPSS Inc., Version 12.0.1 for Windows, Chicago, USA).

Typical error (TE), typical error expressed as a coefficient of variation (CV), and Intraclass correlation coefficient (ICC) were used to determine the reliability of each physiological and performance variable between the three trials (see table 1 and 2). TE and CV were calculated according to the methods of Hopkins (4).

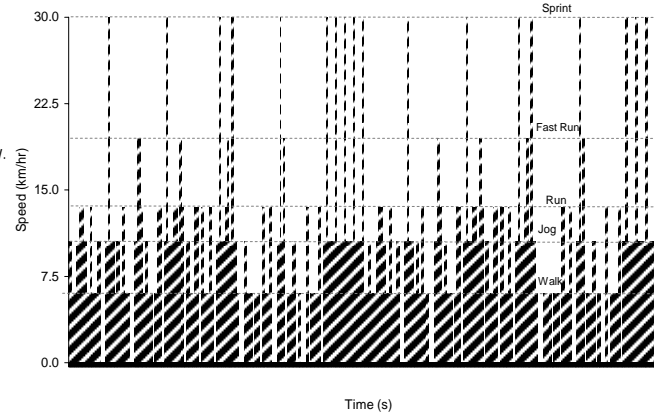


Figure 1: 30 min activity profile for a participant with a maximal speed of $30 \text{ km}\cdot\text{h}^{-1}$. Two 15 min periods were completed with 2 min rest separating each 15 min activity profile.

Results

No significant differences were shown in any of the physiological or performance variables between trial 1-2, trial 2-3 and trial 1-3 ($P < 0.05$).

The mean (\pm SD) total distance covered, 3 s and 6 s sprint distance was $3430.7 \pm 122.2 \text{ m}$, $17.3 \pm 1.5 \text{ m}$, and $36.6 \pm 2.3 \text{ m}$, respectively. The mean (\pm SD) peak running speed was $25.5 \pm 1.4 \text{ km}\cdot\text{h}^{-1}$. The mean (\pm SD) total 5 x 6 s repeated sprint ability (RSA) test distance (sprinting and jogging) was $661.5 \pm 37.7 \text{ m}$.

The mean (\pm SD) heart rate (HR) and blood lactate concentration ([BLa]) for the entire 30 min team sport-specific running protocol was $158.3 \pm 9.9 \text{ bpm}$ and $9.9 \pm 3.3 \text{ mmol}\cdot\text{L}^{-1}$, respectively.

Table 1: Typical error, typical error expressed as a coefficient of variation and Intraclass correlation coefficients for each important performance variable.

	Total Distance (m)	Peak Running Speed ($\text{km}\cdot\text{h}^{-1}$)	5 x 6 s RSA Distance (m)	6 s Sprint Distance (m)	3 s Sprint Distance (m)
Trial 1-2					
TE	74.66	0.43	8.17	1.08	0.88
CV (%)	2.21	1.73	2.40	3.26	5.95
ICC	0.62	0.89	0.88	0.78	0.59
Trial 2-3					
TE	65.04	0.53	12.75	0.32	1.08
CV (%)	1.91	2.01	3.51	0.87	1.29
ICC	0.74	0.85	0.62	0.97	0.92
Trial 1-3					
TE	71.31	0.43	15.11	1.13	0.84
CV (%)	2.14	1.68	4.29	3.34	5.79
ICC	0.68	0.91	0.57	0.78	0.22

TE, typical error; CV, typical error expressed as a coefficient of variation; ICC, Intraclass correlation coefficient; RSA, repeated sprint ability.

Table 2: Typical error, typical error expressed as a coefficient of variation and Intraclass correlation coefficients for each important physiological variable.

	Total Oxygen Consumption (L)	Mean HR First Half (bpm)	Mean HR Second Half (bpm)	Mean [BLa] First Half ($\text{mmol}\cdot\text{L}^{-1}$)	Mean [BLa] Second Half ($\text{mmol}\cdot\text{L}^{-1}$)
Trial 1-2					
TE	2.96	2.32	2.21	1.42	1.44
CV (%)	3.41	1.53	1.37	16.08	20.80
ICC	0.74	0.94	0.96	0.79	0.87
Trial 2-3					
TE	4.05	3.18	2.46	1.40	1.75
CV (%)	4.88	2.16	1.55	18.22	16.17
ICC	0.55	0.90	0.95	0.79	0.75
Trial 1-3					
TE	5.98	2.90	2.98	1.75	2.33
CV (%)	7.13	1.94	1.91	19.19	23.19
ICC	0.15	0.92	0.92	0.63	0.62

TE, typical error; CV, typical error expressed as a coefficient of variation; ICC, Intraclass correlation coefficient; HR, heart rate; [BLa], blood lactate concentration.

Discussion & Conclusions

The activity profile used to simulate team sport match running demands in this study elicited physiological responses that were similar to those reported from match play in a variety of team sports (2,6).

The 30 min team sport-specific running protocol has a high reproducibility and can be considered more reliable than common field tests used to assess the physical capacity and performance of team sport athletes (5).

A 6 s sprint is more reliable than a 3 s sprint on a NMT. Furthermore a 5 x 6 s RSA test can be used reliably on a NMT under pre-fatigued conditions.

These results demonstrate that the NMT system and 30 min team sport-specific running protocol used provide a reliable tool for assessing both key performance variables and physiological measures in team sport athletes. Furthermore, these results indicate that two familiarisation sessions should be completed prior to testing on a NMT.

The present results can be used to interpret meaningful changes in performance and also to determine the appropriate sample size needed for future studies using this protocol.

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