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ORIGINAL ARTICLE

Influence of continuous and discontinuous graded exercise tests with different initial speeds on peak treadmill speed

Influence de tests d'exercice progressif continu et discontinu avec différentes vitesses initiales sur la vitesse optimale sur tapis roulant

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KEYWORDS

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Summary

Objective. – We examined the influence of continuous and discontinuous graded exercise tests performed at different initial speeds on peak treadmill speed values and its relationship with 10-km running performance.

Equipment and methods. – Twenty-one recreational runners performed two continuous and two discontinuous graded exercise tests of different initial speeds on treadmill to determine peak treadmill speed. Protocols were: (a) continuous protocol with initial speed at 8 km·h⁻¹, (b) continuous protocol with initial speed at 10 km·h⁻¹, (c) discontinuous protocol with initial speed at 8 km·h⁻¹, and (d) discontinuous protocol with initial speed at 10 km·h⁻¹. The participants also undertook two 10-km time trials performances.

Results. – The peak treadmill speed obtained during the discontinuous graded exercise tests was higher than the peak treadmill speed reached in the continuous protocols. However, the initial speed did not influence the peak treadmill speed values. The relationships between peak treadmill speed values and 10-km performance differed slightly, and correlations varied between 0.88 and 0.92. Therefore, the peak treadmill speed values are influenced by

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MOTS CLÉS

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the inter-stage rests during graded exercise test but not by the initial speed of the test. Furthermore, due the highest correlations with 10-km, we suggested the use of continuous GXTs for the V_{peak} determination, and with the initial speeds (8 or 10 km·h⁻¹) varying according the performance level of the runners.

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Résumé

Objectif. – Nous avons examiné l'influence de tests d'exercice progressif continu et discontinu effectués à différentes vitesses initiales sur la vitesse optimale sur tapis roulant et sa relation avec la performance à la course sur 10 km.

Matériel et méthodes. – Vingt et un coureurs récréatifs ont effectué deux tests d'exercice progressif continu et discontinu avec différentes vitesses initiales sur le tapis roulant afin de déterminer la vitesse optimale sur tapis roulant. Les protocoles étaient soit : (a) continu avec une vitesse initiale de 8 km·h⁻¹, (b) continu avec une vitesse initiale de 10 km·h⁻¹, (c) discontinu avec une vitesse initiale de 8 km·h⁻¹ et (d) discontinu avec une vitesse initiale de 10 km·h⁻¹. Les participants ont également effectué deux tests de 10 km afin d'évaluer leur performance.

Résultats. – La vitesse optimale sur tapis roulant obtenue était plus élevée durant les tests d'exercice progressif en discontinu qu'en continu. Toutefois, la vitesse initiale n'a pas influencé les valeurs de la vitesse optimale sur tapis roulant. Les relations entre les valeurs de la vitesse optimale sur tapis roulant et la performance sur 10-km étaient quelque peu différentes, avec des coefficients de corrélation variant entre 0,88 et 0,92. Donc, les valeurs de vitesse optimale sur tapis roulant sont influencées par le repos entre les différents stades durant les tests d'exercice progressif mais pas par la vitesse initiale. De plus, en raison des corrélations les plus élevées avec 10-km, nous avons suggéré l'utilisation de tests d'exercice progressif continus pour la détermination de la vitesse optimale sur tapis roulant, et avec les vitesses initiales (8 ou 10 km·h⁻¹), qui varient selon le niveau de la performance des coureurs.

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1. Introduction

The maximum speed obtained during continuous or discontinuous graded exercise tests (GXT), referred to as peak treadmill speed (V_{peak}) in the present study is an effective predictor of performance in endurance races [1–3]. Furthermore, this variable during continuous tests can be determined without the use of metabolic equipment or invasive techniques [4] and presents high test–retest reliability [5]; therefore, its use is recommended for assessing aerobic capability and monitoring training effects.

However, some aspects related to GXT design, including increment rate, stage duration, initial intensity, pauses between stages for blood sample collection, the use of a mask to capture gases, and the criterion to determine the final speed (i.e., complete or proportional final speed criteria) of the GXT can influence V_{peak} values and, consequently, its relationship with endurance running performance [1,3,6].

Kuipers et al. [6] compared three incremental running tests that differed by stage duration and/or speed increment, and reported three different V_{peak} values (18.3, 17.1, and 15.1 km·h⁻¹). Machado et al. [1] examined the influences of three incremental tests with fixed speed increment of 1 km·h⁻¹ and different stage duration (1, 2 and 3 min) and V_{peak} definition on the relationship between V_{peak} and 5- and 10-km running performances; they showed that the V_{peak} obtained in the 3-min stage duration protocol, defined according to Kuipers et al. [6], was the most highly

correlated with both the 5-km ($r=0.95$) and 10-km ($r=0.92$) running performances. Furthermore, Peserico et al. [3] showed that the V_{peak} obtained in a protocol with increments of 1 km·h⁻¹ each 3 min was better correlated with a 1-hour treadmill running performance than protocols with speed increments of 0.5 or 2 km·h⁻¹.

Peserico et al. [5] also reported that the V_{peak} defined according to Kuipers et al. [6] as the speed of the last complete stage added to the product of the speed increment and the completed fraction of the incomplete stage was highly reliable ($1.5\% \leq \text{CV} \leq 1.8\%$). Thus, the authors suggested that other two criteria to determine the V_{peak} should be avoided (i.e., the greatest speed that could be maintained for a complete minute and the speed of the last complete stage).

Although a few studies compared discontinuous and continuous graded running exercise protocols to examine the responses of other physiological variables (i.e., maximal oxygen uptake, $\text{VO}_{2\text{max}}$) [7,8], no study aimed to investigate the influence of the rest between GXT stages (i.e., continuous vs discontinuous protocols) on V_{peak} . Additionally, the effect of the initial speed and its effect on the relationship with performance remains unknown.

Therefore, in the present study, we aimed to examine the influence of continuous and discontinuous GXT performed at different initial speeds on V_{peak} values and its relationship with 10-km running performance. We hypothesized that V_{peak} values would be influenced by the different GXT protocols through both the inter-stage rests (continuous vs. discontinuous) and the initial GXT speed.

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