



ORIGINAL ARTICLE

Physiological and performance responses to high-intensity interval training in female inline speed skaters

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KEYWORDS

Running;
Oxygen consumption;
Anaerobic threshold;
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Skating

Abstract

Objective: To evaluate and compare the effects of high-intensity interval training (HIIT) varying in exercise intensities to traditional endurance training (TET) on physiological and performance adaptations in trained female inline speed skaters.

Methods: Participants were randomly assigned to one of 3 HIIT groups: 6,8,10 (repetitions/session from 1st to 3rd week respectively) \times 60 seconds (s) at the running speed associated with $\dot{V}O_{2\max}$ (100% $\dot{V}O_{2\max}$) (H_{100} , $N=7$), 115% $\dot{V}O_{2\max}$ (H_{115} , $N=7$), and 130% $\dot{V}O_{2\max}$ (H_{130} , $N=7$), 1:3 work to recovery ratio; and/or TET group ($N=7$): 60-minute running at 75% $\dot{V}O_{2\max}$ three sessions per week.

Results: Significant (except as shown) improvements ($p<0.05$) following HIIT were found in: $\dot{V}O_{2\max}$ ($H_{100}=+7.6\%$, $H_{115}=+6.1\%$, $H_{130}=+0.1\%$; $p=0.4$), $v\dot{V}O_{2\max}$ ($H_{100}=+10.3\%$, $H_{115}=+6.3\%$, $H_{130}=+9.8\%$), peak power output (PPO) ($H_{100}=+10.3\%$, $H_{115}=+9.1\%$, $H_{130}=+5.5\%$; $p=0.2$), mean power output (MPO) ($H_{100}=+22.6\%$, $H_{115}=+24.1\%$, $H_{130}=+21.9\%$), 3000 meter (m) skating performance ($H_{100}=-15.2\%$, $H_{115}=-7.9\%$, $H_{130}=-10.6\%$), and T_{\max} ($H_{100}=+39.4\%$, $H_{115}=+5.0\%$; $p=0.5$, $H_{130}=+17.8\%$; $p=0.1$). No significant differences were found among groups. Also, no changes in these variables were found in the TET group.

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PALABRAS CLAVE

Carrera;
Consumo de oxígeno;
Umbral anaeróbico;
Rendimiento deportivo;
Patinaje

Conclusions: Present findings suggest that three weeks of HIIT program with low volume (almost 6 or 10 min per session) is associated with improvements in $\dot{V}O_{2\max}$, $v\dot{V}O_{2\max}$, PPO, MPO, 3000 m skating performance, and T_{\max} in trained female inline speed skaters.

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Respuestas fisiológicas y de rendimiento sobre el entrenamiento a intervalos de alta intensidad en mujeres patinadoras de velocidad en línea

Resumen

Objetivo: Valorar y comparar los efectos de las adaptaciones fisiológicas y de resistencia del entrenamiento por intervalos de alta intensidad (EIAI) sobre el entrenamiento de resistencia tradicional (ERT), modificando la intensidad del ejercicio, en mujeres patinadoras de velocidad en línea entrenadas.

Método: Las participantes fueron asignadas aleatoriamente a uno de los 3 grupos EIAI: 6, 8, 10 (repeticiones/sesión de 1 a 3 semanas respectivamente) \times 60 segundos (s) a una velocidad de carrera asociada al $\dot{V}O_{2\max}$ (100% $v\dot{V}O_{2\max}$) (H_{100} , $n=7$), 115% $v\dot{V}O_{2\max}$ (H_{115} , $n=7$), y 130% $v\dot{V}O_{2\max}$ (H_{130} , $n=7$), 1:3 relación esfuerzo recuperación; y/o grupo ERT ($n=7$): 60 min de carrera 75% $v\dot{V}O_{2\max}$ tres sesiones por semana.

Resultados: Se hallaron las siguientes mejoras significativas ($p<0,05$) (excepto, como se indica EIAI en: $\dot{V}O_{2\max}$ ($H_{100}=+7,6\%$, $H_{115}=+6,1\%$, $H_{130}=+0,1\%$; $p=0,4$), $v\dot{V}O_{2\max}$ ($H_{100}=+10,3\%$, $H_{115}=+6,3\%$, $H_{130}=+9,8\%$), pico de potencia máxima (PPO) ($H_{100}=+10,3\%$, $H_{115}=+9,1\%$, $H_{130}=+5,5\%$; $p=0,2$), potencia media (MPO) ($H_{100}=+22,6\%$, $H_{115}=+24,1\%$, $H_{130}=+21,9\%$), rendimiento 3.000 metros (m) de patinaje ($H_{100}=-15,2\%$, $H_{115}=-7,9\%$, $H_{130}=-10,6\%$), y T_{\max} ($H_{100}=+39,4\%$, $H_{115}=+5,0\%$; $p=0,5$, $H_{130}=+17,8\%$; $p=0,1$). No se hallaron diferencias entre los grupos. Tampoco se hallaron cambios en estas variables en el grupo ERT.

Conclusiones: Estos hallazgos sugieren que tres semanas de un programa EIAI, a un entrenamiento bajo (unos 6 o 10 min por sesión), se asocia a mejoras en el rendimiento de 3.000 m de patinaje en $\dot{V}O_{2\max}$, $v\dot{V}O_{2\max}$, PPO, MPO, y T_{\max} en mujeres patinadoras de velocidad en línea entrenadas.

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Introduction

Inline speed skating at the World Championships is divided into two major disciplines; track and road racing. Official distances of track races range from 300 m to 15,000 m and road races range from 200 m to 42,195 m. Both track and road races require high intensity bouts of sprinting, interspersed with short periods of low-to-moderate intensity "rest" periods.¹ Success in inline speed skating has been attributed to powerful starts and high rates of ATP re-phosphorylation via non-oxidative ("anaerobic")^{2,3} and oxidative metabolism.^{4,5} As such, inline speed skaters require well-developed anaerobic and aerobic energy systems.^{2,5,6}

Inline speed skaters are required to obtain peak performance several times over an annual training. Training programs capable of increasing aerobic metabolism are based mainly on periods of at least 6 weeks and such programs are often based on continuous endurance training,⁷ in these cases, low-volume HIIT may represent an

alternative to endurance training to improve aerobic and anaerobic performance in a short time frame.¹³

High-intensity interval training (HIIT) is a potent training stimulus to improve anaerobic and aerobic energy systems⁸⁻¹¹ over a short time period (e.g., 6 sessions over 2 weeks^{12,13}). HIIT performed with various intensities (% $v\dot{V}O_{2\max}$) have been used to improve performance in athletes from a wide range of sports;^{10,14} however, to date information regarding the effects of HIIT on performance in female inline speed skating athletes is limited. Furthermore, Because of the paucity of data that relate directly to our understanding of the physiological and performance adaptations that occur following high-intensity interval training in trained athletes,¹⁴ it is unclear which intensity of HIIT is more effective for improving required adaptations of female speed skaters in short period. Accordingly, the aim of the present study was to examine the effects of three different HIIT protocols with different intensities (100, 115, and 130% velocity at $\dot{V}O_{2\max}$ [$v\dot{V}O_{2\max}$]) compared to traditional endurance training (TET) over 3 weeks on

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