



ORIGINAL ARTICLE

Can running kinetics be modified using a barefoot training program?

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Received 12 August 2017; accepted 27 November 2017

KEYWORDS

Athletic performance;
Joints;
Running;
Resistance;
Unshod

Abstract

Introduction: There is limited information about barefoot transition programs and this study will help to increase knowledge about this growing trend. The purpose of this study was, therefore, to determine the effect of a twelve-week barefoot training program on kinematic variables in long-distance runners.

Materials and methods: A total of 32 well-trained, habitually shod, long-distance runners, randomized in a control group and an experimental group who undertook a barefoot training program. At pre-test and post-test, all participants, wearing their usual sneakers, performed running tests at self-selected recovery and competitive running speeds on a treadmill. Both conditions were recorded with a 240 Hz video rate system and analyzed using a 2-D video editing program using photogrammetric techniques. Contact time, flight time, step duration and cadence were measured using an analysis of variance (ANOVA) with repeated measures was performed.

Results: In posttest, only the duration of landing phase at high speed showed significant difference, the experimental group achieved a shorter time than the control group after the barefoot training program (0.032 ± 0.007 s vs. 0.038 ± 0.006 s). In relation to within-group differences, the control group showed an increase of duration of stance phase at low speed ($\Delta = 0.014$ s, $p = 0.024$) and a reduction of flight time at high speed ($\Delta = -0.014$ s, $p = 0.034$). Moreover, the experimental group achieved a reduction of duration of landing phase at high speed ($\Delta = -0.008$ s, $p = 0.004$).

Conclusions: A twelve-week program of barefoot running changes the duration of the landing phase at high speed, being shorter in long-distance runners. In contrast, the runners who did not undertake the training showed an increase of duration of stance phase at low speed.

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PALABRAS CLAVE

Desempeño atlético;
Articulaciones;
Carrera;
Resistencia;
Descalzo

¿Puede modificarse la cinética de la carrera mediante un programa de entrenamiento descalcista?

Resumen

Introducción: Existe información limitada acerca de los programas de transición a carrera descalza, y este estudio ayudará a incrementar el conocimiento acerca de esta tendencia creciente. Por tanto, el objetivo de este estudio fue determinar el efecto de un programa de entrenamiento descalcista de 12 semanas sobre las variables cinéticas en los corredores de larga distancia.

Materiales y métodos: Un total de 32 corredores de larga distancia, bien entrenados, y habitualmente calzados, fueron distribuidos aleatoriamente en un grupo experimental para llevar a cabo un programa de entrenamiento descalcista. Durante las pruebas previas y posteriores, todos los participantes realizaron las pruebas a velocidades de carrera de recuperación y competitiva auto-seleccionadas, utilizando sus zapatillas deportivas en una cinta ergométrica. Ambas situaciones se registraron con un sistema de calificación por video de 240Hz, y se analizaron mediante un programa de edición de video 2D con técnicas fotogramétricas. Se midieron el tiempo de contacto, la duración del paso y la cadencia mediante análisis de la varianza (ANOVA) con mediciones repetidas.

Resultados: En la prueba posterior, solo la duración de la fase de aterrizaje a alta velocidad reflejó una diferencia significativa, logrando el grupo experimental un tiempo inferior que el grupo control tras el programa de entrenamiento descalcista ($0,032 \pm 0,007$ s frente a $0,038 \pm 0,006$ s). Con relación a las diferencias entre grupos, el grupo control reflejó un incremento en la duración de la fase de apoyo a baja velocidad ($\Delta = 0,014$ s; $p = 0,024$) y una reducción del tiempo de vuelo a alta velocidad ($\Delta = -0,014$ s; $p = 0,034$). Además, el grupo experimental logró una reducción de la duración de la fase de aterrizaje a alta velocidad ($\Delta = -0,008$ s; $p = 0,004$).

Conclusiones: Un programa de carrera descalcista de 12 semanas modifica la duración de la fase de aterrizaje a alta velocidad, que es más corta en los corredores de larga distancia. Por contra, los corredores que no realizaron el entrenamiento reflejaron un incremento de la duración de la fase de apoyo a baja velocidad.

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Introduction

Some authors suggest that habitual barefoot running could prevent impact-related injuries.¹⁻³ Some studies pointed that humans had been made to run barefoot, and this running style can minimize impact peaks and provides increased proprioception and foot strength, also is hypothesized that can help avoid injury.⁴ In order to reduce the risk of injury, the runner's body produces changes in lower limb kinematics. Some authors have measured the risk of injury in runners' feet before and after a training period transitioning from traditional to minimalist running shoes, participants in the training group showed significant increases in bone marrow edema in at least one bone after the training running period.^{5,6} Furthermore, barefoot running is also associated with a shorter stride a higher stride cadence both low and high running speed,^{7,8} reducing stride length decreased the probability of stress fracture by 3-6%.⁵

Previous studies of barefoot running specify even more the kinematic changes such as: shorter step length and larger step frequency, shorter landing phase, shorter contact time, shorter flight time and shorter step time.⁷⁻¹¹ Barefoot running is also related with a higher stride cadence both low and high running speed.^{7,8} In addition, barefoot running

reduces flight time and causes a lower peak force and higher pre-activation of the sural triceps than shod running.¹²

A recent study pointed that an intervention of six weeks of barefoot training simulation using Vibram Five-fingers shoes, is associated with a significant decrease in the loading rates and impact forces.¹³ Other study question about the process in which biomechanical adaptations happen and if these can be learned by everyone.¹⁴ It remains to be seen how training based on barefoot running can modify the kinematics of traditionally shod running. There are many aspects concerning the manner in which the athletes adapt kinematics variables to run after specific barefoot training but there is already no evidence for long term effects of barefoot running regarding biomechanics or health outcomes.¹⁵ This insight could be enhanced by studying the difference in kinematics after a sufficiently long controlled barefoot training program (BTP).

Considering the above information, we hypothesized that neuromuscular adaptations to BTP might be responsible for the change in kinematic variables in shod condition post-intervention. Therefore, the purpose of this study is to determine if after the 12-week barefoot intervention the pointed variables will be modified even when running shoes are put on.

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