

CHANGES IN ANGULAR MOMENTUM DURING 10,000 M RACES

Yasushi Enomoto, Yuta Suzuki* , Tetsu Chiba, Kanko Sugimoto, Hirosuke Kadono*,
and Michiyoshi Ae*

Kyoto University of Education, Kyoto, Japan

* University of Tsukuba, Tsukuba, Japan

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INTRODUCTION: In distance running, many coaches and runners pay attention not only to leg motion but also to arm and trunk motion. Hinrich (1987) studied angular momentum in running and suggested that main role of arm and trunk motion in running was to maintain the balance about vertical axis against leg motion. Unfortunately, there was little biomechanical study about arm and trunk motion for elite distance runners in races. The purpose of this study was to investigate the angular momentum about vertical axis for elite distance runners in the 10000m races.

METHOD: The international 10,000 m races that include World Championships Osaka 2007 were videotaped using two digital video cameras. Seven world class runners and four Japanese runners were chosen as the subjects. Using DLT technique, three dimensional coordinates of the runners were reconstructed in one running cycle at the four stages of 10000m races. After smoothing, the centre of mass and moment of inertia of each segment was estimated using the coefficients of Japanese athlete model (Ae, 1991). Angular momentum of each segment about the absolute coordinate axes was calculated without long axial rotation of limbs (Hinrich, 1986). These values were normalized by dividing the square body height and the body weight of the subjects and multiplying by 1000.

RESULTS: Figure shows changes in the angular momentum about vertical axis for the world's top and Japanese top runners at the late stage of 10000m race. The angular momentum of head and trunk (HAT), legs and arms for the world's top runner changed greatly but the total angular momentum didn't change greatly compared to the Japanese top runner.

DISCUSSION: The world's top distance runner showed greater change in legs and arms angular momentum, while total angular impulse was smaller than the Japanese top runner. These results indicate that the world's top runner swung the legs widely and rapidly and the arm swing and trunk axial rotation compensated for leg motion to maintain the balance effectively.

CONCLUSION: The findings suggest that the angular momentum about vertical axis may give an useful insight to evaluate for distance running techniques about not only leg motion but also arm and trunk motion.

REFERENCES:

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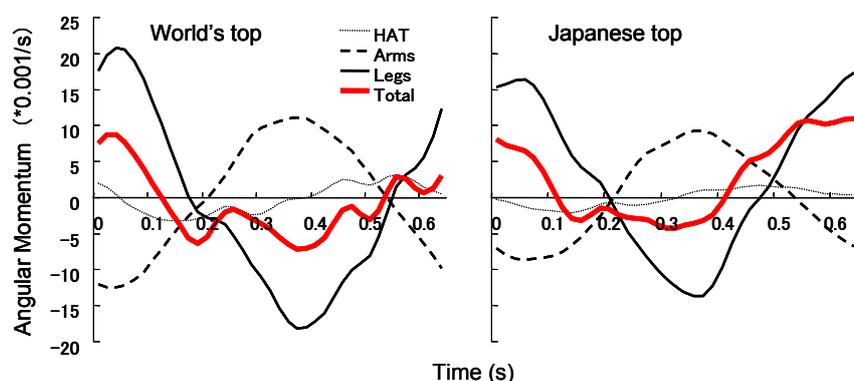


Figure Changes in the head and trunk (HAT), arms, legs and total angular momentum during a cycle (from left foot contact (LFC) to next LFC) for the world's top and the Japanese top runner.