

RUNNING ECONOMY AND RUNNING MECHANICS FOR KENYAN AND JAPANESE ELITE RUNNERS

¹Yasushi Enomoto, ²Toshiharu Yokozawa, ³Hidetaka Okada, ⁴Toshihiro Shibutani, ⁵Kazunobu Okazaki, ⁶Yasunori Morioka,
²Taketeru Maegawa, ²Junji Takamatsu, ²Hideyuki Takahashi and ⁷Masaaki Sugita

¹Kyoto University of Education, ²Japan Institute of Sports Sciences, ³The University of Electro-Communications,
⁴Biwako Seikei Sport College, ⁵Osaka City University, ⁶Japan Sports Association, ⁷Japanese Olympic Committee
email: enomoto@kyokyo-u.ac.jp

INTRODUCTION

Kenyan distance runners have shown great success in the international distance races. There are a few studies about physiological and biomechanical characteristics of Kenyan elite runners. Saltin [1] reported that the Kenyan elite runners shows lower energy consumption at a given running speed and have the thinner lower leg than European runners. They concluded that a key factor for the Kenyan high performance of distance running was higher running economy due to thin shanks. These relationships, however, could not be explained directly. Enomoto and Ae [2] indicated that Kenyan runners may have better running technique than Japanese runners with respect to recovery leg motion. Williams and Cavanagh [3] indicated that running economy for distance runners was influenced greatly by running mechanics. These facts suggested that Kenyan runner's economy may be explained by running mechanics, which may play an important role to improve running performance for Japanese distance runners. The purpose of this study was to compare running economy and running mechanics of Kenyan runners with Japanese runners and to get a insight into the running technique for improving Japanese runner's performances.

METHODS

Five elite Kenyan and five elite Japanese runners were recruited as subjects of this study. This study was a part of the project of JAAF. After the thorough explanation of the study, informed consents were obtained. Their oxygen consumptions at 320, 340 and 360 m/min were measured on the treadmill and their motion in running at a race speed were captured on the running ground using VICON (120 Hz). Three-dimensional coordinates in a running cycle were obtained. After smoothing, joint torque, angular momentum, mechanical energy and work in sagittal (Y-Z) plane were calculated for evaluating running mechanics.

RESULTS AND DISCUSSION

Oxygen consumptions for Kenyan and Japanese runners at 340 m/min were 58.1 ± 3.9 and 66.0 ± 4.3 ml/min/kg, those at 360 m/min were 63.6 ± 3.8 , 73.5 ± 8.2 ml/min/kg, respectively. These indicated that running economy for Kenyan runners was better than Japanese runners.

Effectiveness of mechanical energy utilization to running velocity [4] was not shown significant difference between Kenyan and Japanese runners but one Kenyan runner who won the bronze medal at 10,000 m in Osaka World Championships showed greatest values of effectiveness among the subjects. Mechanical work and power also did not show the significant difference between Kenyan and Japanese runners and not significant relationships of these variables to running economy.

Figure shows the relationship between oxygen consumption at 360 m/min and average angular momentum about medio-lateral (X) axis through the center of mass of the body in running cycle. Kenyan runners showed that their angular momentum has not greater maximal negative value but little change during support. Kram [5] indicated that running cost was influenced by not only mechanical work but also muscular force in the support phase. Change in angular momentum about medio-lateral axis during the support would indicate angular impulse of moment of GRF about the center of mass of the body. These facts suggest that change in angular momentum about medio-lateral axis during support might increase oxygen consumption due to waste energy to generate joint torques of lower limb joints for stabilizing a body and angular momentum about medio-lateral axis may be a crucial insight into an evaluation of distance running techniques.

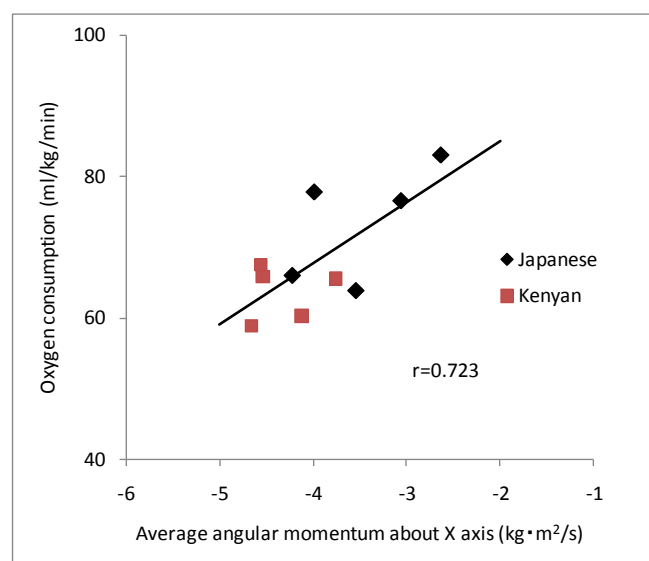


Figure : Relationship between average angular momentum about medio-lateral (X) axis in a running cycle and oxygen consumption at 360 m/min.

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