MUSCULOSKELETAL CHARACTERISTICS FOR EAST-AFRICAN TOP DISTANCE RUNNERS

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It is believed that East-African top level distance runners (EAR) may possess the specific muscle-tendon characteristics of lower-leg. This study was to examine the specificity of the musculoskeletal characteristics for EAR by comparing the musculoskeletal characteristics of lower-leg between East-Africans. Three East-African groups (Top level runners: n=18, Trained runners: n=32, control males: n=19) were recruited. Their Achilles tendon (AT) length, its cross-sectional area (CSA) and its moment arm as well as the gastrocnemius fascicle length were measured by ultrasonography. The results clearly showed that the AT length, its moment arm and the fascicle length were similar in all groups, respectively. These results suggest that the musculoskeletal characteristics of lower-leg for EAR except for the AT CSA were the racial (physiological) characteristics rather than the results of the training adaptation.

KEY WORDS: ULTRASOUND, ACHILLES TENDON, MOMENT ARM.

INTRODUCTION: It has been reported that East-African top level distance runners (EAR) was characterized by exceptionally long Achilles tendon and its moment arm (MA_AT), associated with short fascicles of the medial gastrocnemius (MG) muscle (Kunimasa et al., 2014). A longer MA_AT may reduce the Achilles tendon force and triceps surae muscle activities to produce a given ankle extension torque. In hopping and running, EAR presented an overall smaller EMG activities and ranges of MG tendon and fascicle length changes during ground contact, but a greater shortening to stretching ratio of the MG tendon, which would reflect an efficient use of tendinous elasticity (Sano et al., 2013). The question arises as to whether the specific musculoskeletal characteristics of lower-leg for EAR can result from the racial aspects or the training adaptation. Therefore, the purpose of the present study was to compare the musculoskeletal characteristics of lower-leg between East-Africans to examine the specificity of the musculoskeletal characteristics for EAR. It was hypothesized that the musculoskeletal characteristics of lower-leg for EAR were not different from the trained East-African runners and healthy non-competitive adults. These specific musculoskeletal characteristics of lower-leg for EAR in the East-African area may be the racial (physiological) characteristics rather than the results of the training adaptation.
METHODS: Three East-African groups were recruited for this study: top level East-African distance runners (EAR: n=18), well trained East-African distance runners (Trained runners: n=32), and healthy non-competitive East-African male adults (CTRL: n=19). Their Achilles tendon (AT) length, its cross-sectional area (CSA) and MA\textsubscript{AT} as well as the muscle fascicle length of medial gastrocnemius muscles (L\textsubscript{Fa}) were measured by musculoskeletal ultrasonography. The AT length was measured from the AT insertion point on the calcaneus to the distal point of the AT junction between medial and lateral gastrocnemii muscles. The AT CSA was quantified below the distal end of soleus muscle. The MA\textsubscript{AT} was measured in a standing position by ultrasonography with transverse plane images and was calculated by the Heron's formula (Weisstein from MathWorld) as follows:

\[
L = \frac{1}{2}(L_{\text{mal}} + L_{\text{med}} + L_{\text{lat}})
\]

\[
\text{MA}_{\text{AT}} = \frac{2 \sqrt{s(s - L_{\text{mal}})(s - L_{\text{med}})(s - L_{\text{lat}})}}{L_{\text{mal}}}
\]

where L\textsubscript{mal} and L\textsubscript{lat} are the lengths from Achilles tendon to the tips of the medial and lateral malleoli by ultrasonography and L\textsubscript{med} is the distance between medial and lateral malleoli by Martin Breadth Caliper and MA\textsubscript{AT} is the Achilles tendon moment arm.

Values are presented as means and standard deviations for each group. A one-way analysis of variance (ANOVA) was used to compare each parameter between groups. When the results of an ANOVA test were statistically significant, the Tukey’s post hoc tests were used to determine whether there were any group differences. A criterion alpha level of p < 0.05 was used to determine statistical significance for all data.

RESULTS/DISCUSSION: The AT length, MA\textsubscript{AT} and L\textsubscript{Fa} did not show any significant differences between groups, respectively (Table 1). However, the AT CSA was significantly smaller in EAR and trained runners than in other groups (p<0.00). The specific musculoskeletal characteristics of lower-leg for EAR (Kunimasa et al 2014) cannot be necessarily due to the training adaptation to the distance running. Our results indicate that the musculoskeletal characteristics of lower-leg for EAR except for the AT CSA in the East-African area were the racial (physiological) characteristics rather than the results of the training adaptation. Therefore, the East-Africans can have physiological advantages for long distance running. On the other hand, the AT CSA was smaller in runners than in CTRL. In the previous study (Kunimasa et al., 2014), the AT CSA was greater in EAR than in the elite Japanese distance runners, but there was not any relationship between the AT CSA and the running performance. Consequently, the small AT CSA may be characterized by the long distance runners. It may be important to check some anthropometric parameters related to the running performance for the athlete selection of the long distance runners.
CONCLUSION: This study clearly confirmed that the musculoskeletal characteristics of lower-leg for EAR were not any significant differences from the trained East-African runners and healthy non-competitive adults. Consequently, these specific musculoskeletal characteristics of lower-leg for EAR in the East-African area may be the racial (physiological) characteristics rather than the results of the training adaptation.

REFERENCES:

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