CHARACTERISTICS OF BODY MOTION IN A NOVICE RACE WALKER

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The purpose of this study was to clarify the movement characteristics of novice race walkers using kinematics analysis. A junior high school newcomer 5km race was videotaped at 60 field/s with a video camera. The subjects were 16 junior high school student race walkers. The results were summarized as follows, (1) The stance phase of the novice race walkers was longer than that of experienced walkers referred to several previous studies. (2) There was a significant relationship between the walking speed and the step length in experienced walkers and faster novice walkers. However, the group of slower walkers in this study had a small stride length, and there was no significant relationship between the walking speed and the step length.

KEY WORDS: race walking, kinematics, gait, novice athletes, motion analysis, walking stride

INTRODUCTION: Race walking is due to the rules restraining the competitor certain movement patterns. According to the IAAF RULE 230 (extract from IAAF Competition Rules 2014-2015), “Race Walking is a progression of steps so taken that the walker makes contact with the ground, so that no visible (to the human eye) loss of contact occurs. The advancing leg must be straightened (i.e. not bent at the knee) from the moment of first contact with the ground until the vertical upright position. ”

Cairns et al. (1986) reported that in race walking, the percent of the cycle spent on the stance phase decreased, and the percentage of the cycle spent in the swing phase increased so that, at the competitive velocity, the stance and swing phases were nearly equal. White et al. (1985) showed that the greatest rate of change in angular displacements occurred at the initial and late stages of stance and during the swing cycles. Hoga (2006) reported that there was significant relationship between the walking speed (3.80 ± 0.20m/s) and the step length (1.13 ± 0.05m), and also walking speed and step length ratio to the body height (0.66 ± 0.03). There have previously been some studies done regarding race walking, but there has been no study about the characteristics of novice race walkers using a biomechanical approach. The purpose of this study was to clarify the movement characteristics of novice race walkers using kinematics analysis.

METHODS: A junior high school newcomer 5km race was videotaped at 60 field/s with a video camera. They were 16 junior high school student race walkers. They were separated into two haves based on their speed. The first half (a) consists of the top eight walkers and the other consists (b) of rest. Two-dimensional coordinate data were used to calculate joint angle, angular velocity and stride length.

Analyzed motion was divided stance phase, plantar contact phase, double limb support, swing phase as a percent of total cycle time of one leg, and in analysis of joint angle and angular velocity divided into three phases normalized as 100 % of stance or swing phase. After calculation of the smoothing the coordinate data using a digital Butterworth filter.

Statistics analysis were using Peason's product moment correlation coefficients and independent t-tests. Peason's product moment correlation coefficients for the walking speed to the step length and frequency. Independent t-tests were conducted to compare values between groups. Statistical significance was accepted at $P < 0.05$.

RESULTS AND DISCUSSION: The group of faster walkers and the group of slower walkers in comparison with experienced walkers from preceding studies, stance phase longer than swing phase as a percent of total cycle time of one leg. In Figure 1, the group of faster walkers and the group of slower walkers showed that stance phase longer than swing phase as a percent of total cycle time of one leg. The group of faster walkers (during stance phase; 54.0 ± 4%, swing phase; 46.0 ± 4%), the group of slower walkers (56.8 ± 2%, 43.2 ± 2%).

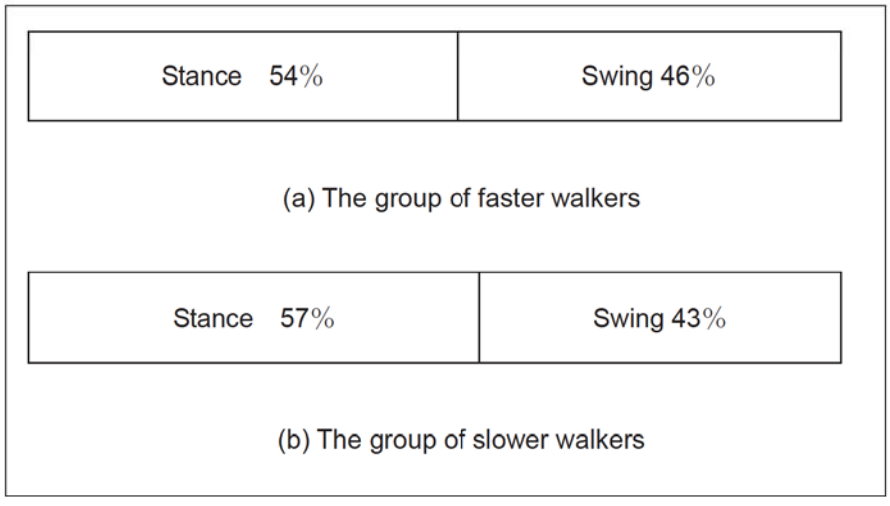

Figure1: Average duration of stance and swing as a percent of total cycle time.

This result was different from the precedent studies. Murry et al. (1983) suggest that as compared to the men walking fast, the race walkers had a faster cadence, longer and slightly narrower strides, and less out-toeing. In the race walkers, the duration of the stance phase decreased and the duration of the swing phase increased, which resulted in nearly equal stance phases and swing phases. The same result was shown in the research by Cairns et al. (1986).

Figure 2 shows relationships between the walking speed and the step length of the novice race walkers. There was significant relationship between walking speed and the step length in precedent study and a novice upper group. And also there was a significant relationship between the walking speed and step length ratio to the body height. However, the group of slower walkers in this study had a small stride length, and there was no significant relationship between the walking speed and the step length, nor walking speed and step length ratio to the body height.

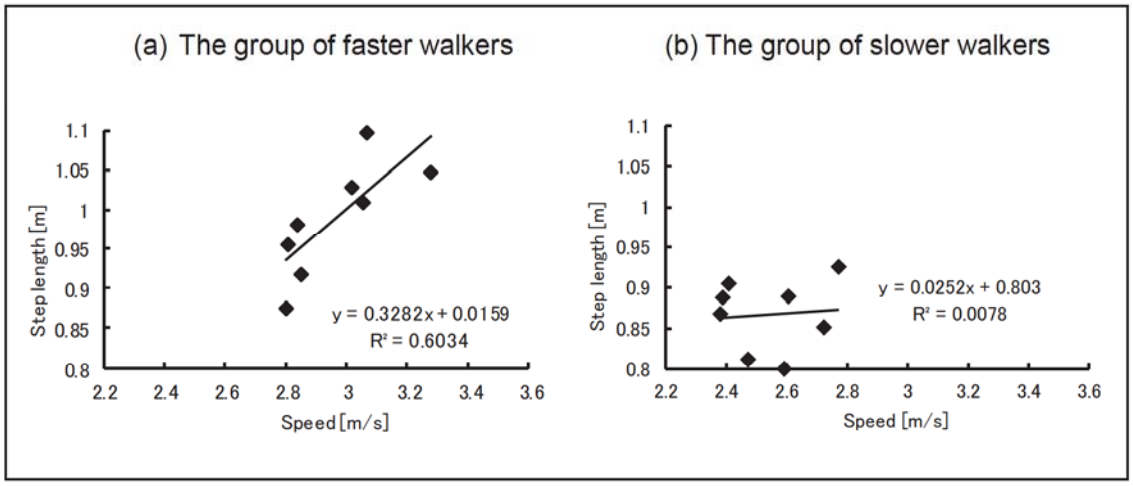

Figure 2: Relationships between the walking speed and the step length of (a) the group of faster walkers and (b) the group of slower walkers.

CONCLUSION: The aim of this study was to clarify the movement characteristics of novice race walkers using kinematics analysis. The results of this study show that the novice race walkers had a small stride length, and stance phase longer than swing phase. Race walking is due to the rules restraining the competitor certain movement patterns. Skill practice is important for contrary to the rules. The results of this study suggest that a novice race walker's training the shorter the stance phase and longer the swing phase, and the longer the stride length.

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