

THE STUDY OF THE AREA OF FOOTPATH BETWEEN MALE AND FEMALE ELITE DISTANT RUNNERS UNDER DIFFERENT RUNNING SPEEDS OF A TREADMILL

Jin-Cherng Wang, Ming-Hsun Lin and Yu-Hsiung Lu

Department of Physical Education, National Chiayi University, Chiayi, Chinese Taipei

The purpose of this study was to investigate and to compare the difference of area of footpath between male and female elite distant runners under 3 m/s and 4 m/s running speeds on a treadmill. There were 9 male and 7 female subjects jointed this study. AJVC DVL-9800 digital camera was utilized to record subject's running movement, and the Ariel Performance Analysis System was used for digitizing. The t-test statistics was used to test the difference between variables. The results indicated that both male and female runners' areas of footpaths were greater when the running speed was increased, and there was no significant difference between male and female runners.

KEY WORDS: footpath, running

INTRODUCTION: According to the papers of Hopper (1973) and Cavanagh (1990), they both indicated that the area of runner's footpath could be a good variable of evaluation for determination the speed or running skill. But difference of the area of footpath between elite male and female distant runner and the difference between faster and slower runner were unreported. Therefore, the main purpose of this study was to investigate and to compare the difference of area of footpath between male and female elite distant runners under 3 m/s and 4 m/s running speeds on a treadmill.

METHODS: There were 9 male and 7 female elite distant runners to be selected as the subjects of this study and their basic characteristics were shown as Table 1.

Table 1 The basic characteristics of subjects.

Sex	No	Height (cm)	Weight (kg)	Age (yr)
male	9	172.8 ± 5.5	63.1 ± 5.4	20.6 ± 1.3
female	7	164.3 ± 6.6	52.3 ± 5.1	20.9 ± 1.9

Subjects were asked to run on a treadmill under the speeds of 3 m/s and 4 m/s, and their running movements were recorded by a JVC DVL-9800 digital camera. The Ariel Performance Analysis System (APAS v5.0) was used for digitizing. After digitizing, the path of subject's ankle joint was selected to represent the footpath of running. The 6 orders of polynomial cure fit technique was utilized to fit the equation of the footpath of running, and the area of footpath was then calculated by the mathematic integration. Finally, the t-test of SPSS statistic software was used for testing the difference between variables.

RESULTS: The results of area of footpath under different running speeds were shown as Table 2.

Table 2 Area of footpath under different running speeds.

Sex	Speed of 3 m/s (m^2)	Speed of 4 m/s (m^2)
male	0.102 ± 0.028	0.177 ± 0.039
female	0.093 ± 0.024	0.150 ± 0.029

1. The mean area of footpath of male runner were $0.102 \pm 0.028 m^2$ and $0.177 \pm 0.039 m^2$ under the speed of 3 m/s and 4 m/s.
2. The mean area of footpath of female runner were $0.093 \pm 0.024 m^2$ and $0.150 \pm 0.029 m^2$ under the speed of 3 m/s and 4 m/s.
3. In both male and female runners there was significant difference between two different speeds ($p < 0.05$).

4. At the same running speed, there was no significant difference between male and female runners.

DISCUSSION: The result 1 and 2 were shown above gave a quantitative value of male and female elite distant runners' area of footpath while they were running on a treadmill, and it provided experimental quantity which was not reported by literatures. For a well trained distant runner, the posture and body movement will be constant and stable while they are running either on the track field or on a treadmill. And when they increase their running speed on the ground, the length of foot strike will be also increased. As long as the strike length is increased, the area of footpath will be increased naturally. This result also indicated that the speed of 3 m/s and 4 m/s could be a significantly distinguish the runner's posture and body movement while they were running, and this could be a useful character for evaluating runner's running skill.

CONCLUSION: The value of area of footpath could be a indication of running speed for elite distant runners, and there was no significant difference between male and female runners. In the future study, it possible to utilize the area of footpath of running to develop a index for evaluating the running skill for distant runner.

REFERENCES:

- Peter, R. Cavanagh. (1990). *Biomechanics of Distance Running*. Champaign: Human Kinetics Publishers.
- B. J. Hopper. (1973). *The Mechanics of Human Movement*. Lodon: Crosby Lockwood Staples.