

# THE EFFECT OF FREE LEG MOVEMENT ON TAKE-OFF IN ELITE CHINESE WOMEN LONG JUMPER

Gang Xu

Shenyang Institute of Physical Education, Shenyang, Liaoning,  
People's Republic of China

**KEY WORDS:** long jump, take-off, effect-of-take-off, free leg, kinematics

**INTRODUCTION:** The purpose of this study is to investigate relationships between free leg motions and long jump performance during the take-off phase.

**METHODS:** The subjects selected for this study included 10 elite female long jumpers who competed in the 1997 National Games held in Shanghai, China. Several performances of each subject were recorded on one high-speed camera, operating at 100 frames per second under competition conditions. The camera was placed perpendicular to the plane of motions and filmed the last step of the approach run and take-off phase. The trial that yield the longest official distance for each subject was selected for further analysis. For the biomechanical analysis, a 15-segment model was used to represent the rigid body and calculated via 20 landmarks. By way of photo-analysis and statistical induction, the data were surveyed and the following was concluded.

**RESULTS AND DISCUSSION:** The standard of the competition was high, which is illustrated by the mean of  $6.64 \pm 0.20$ m and a best result of 7.01m. Based on the kinematics parameters of segments and the center of gravity of the whole body (G), the point of maximum knee flexion of free leg in the last step of approach run was established and used to represent the point at which the take-off action had begun. The quick extending of free leg accelerated G. The mean angular velocity of extending in hip is  $745.758 \pm 127.594$ d/s and the mean scope is  $35.845 \pm 9.841$ d. The angular velocity and scope of extending in hip is much bigger than that in knee. The action is beneficial to following swing forward of free leg. Then the free leg swings forwards quickly. The mean angular velocity is  $969.410 \pm 116.739$ d/s. It has a significant positive correlation with the effect of flexion and extension of the take-off leg and the lift of position of G. It can also advance the hip of take-off leg to keep extending tendency and accelerate the flexion and extension of the knee of take-off leg. Summarily, the positive action of free leg can take good advantages of the running velocity and be helpful to the increase in vertical velocity of G. So it is of major importance for the take-off phase and benefit to generate the vertical position, take-off velocity and take-off angle of G at the instant of jumping.

**CONCLUSION:** It was concluded that the actions of free leg contribute to take-off and the result of long jump. It's reasonable to take the point of maximum knee flexion of free leg in the last step of approach run as the instant at which the take-off actions had begun. It can emphasize the closely compacted actions of the approach run and take-off. Further more, the action of Chinese women's long jump is comparatively quick and positive. Increased muscle strength would benefit extension and swing on the free leg.