INFLUENCE OF BODY WEIGHT ON PULLING FORCE IN HAMMER THROW

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INTRODUCTION: In hammer throw it can be considered that the body weight affects the throwing distance because the muscle volume is directly proportional to the body weight. The pulling force of the hammer may also be affected by the body weight. The purpose of this study was to investigate the influence of the body weight on the pulling force during throwing motion in hammer throw.

METHOD: Throwing motions of 2 elite hammer throwers were recorded by 2 synchronized high-speed video cameras (200 fps) in two international athletic meets. Three-dimensional co-ordinates of body segments and hammer head were obtained with DLT techniques (Abdel-Aziz and Karara, 1971). Initial conditions at release and maximum pulling force acting on hammer head during throwing motion were calculated.

RESULTS: Throwing distance, initial conditions at release and maximum pulling force and body weight of the throwers are shown in Table 1. Throwing distance and initial conditions were similar for the two throwers. However, maximum pulling forces per body weight were quite different.

Table 1 Initial conditions, maximum force and body weight

Subject	Result (m)	Initial Velocity (m/s)	Release angle (deg)	Height (m)	Max. Pull Force (kgw)	Max. Pull Force/Weight (kgw/kg)	Weight (kg)
A	76.37	28.4	40.0	1.46	324	3.60	90
B	76.67	28.9	38.3	1.84	307	2.74	112

DISCUSSION: The hammer throwing motion can be compared to two-body problem in the physics between a thrower's body and a hammer head. Therefore, it can be considered that body and hammer head rotate each other around the common center of mass of these two bodies. In this study, the body weight of subject B was larger than that of subject A about 24%. Then radius of rotation from the common center of gravity to hammer head in subject B was longer than in subject A. As the velocity of the hammer head at release were almost the same in two throwers, subject A's pulling force was larger than subject B's one because the centrifugal force (= the pulling force) was inversely proportional to the radius of rotation.

CONCLUSION: This study identified the influence of body weight on pulling force during the hammer throwing motion. It was concluded that the thrower with smaller body weight had a disadvantage, from the mechanical viewpoints as well as muscle volume.

REFERENCES:

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