THE EFFECTS OF SHOT WEIGHT ON THROWING POWER OUTPUT IN ELITE FEMALE SHOT PUTTTERS

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INTRODUCTION: Sport specific strength development is one of the key factors of the efficient training for throwing athletes (Liu, 1996). Little research has been conducted to examine the appropriate weight of shot that could develop specific strength and promote maximum power output in shot put. The purpose of this study was to compare the power and strength output induced by different weight selected for shot-put exercise in elite female shot putters.

METHODS: Two high-speed cine-cameras were used to record the shot-put movements performed by 10 elite Chinese female shot putters at national level. Each subject put 10 different weight (4, 4.5, 5, 5.5, 6, 6.5, 7.2, 8, 8.5 and 9 kg) of shot. Each weight were putted for three times and the best result in each weight was used for data reduction. The mean age and personal best records of the subjects were 24±2.5 years and 20.25±0.72 m respectively. The selected film material was digitized on computerized 3-D motion analysis system to provide kinematic data of the shot-put movement including the height, angle and speed at the release and at the initial movement, and the time interval from the initial movement to the release.
The average power of shot put was calculated with the following formula:

$$P = \frac{W}{t}$$

where t is the duration of the movement from initial movement to release, W is the work done on the shot during t, which is in turn the sum of the changes in kinematic and potential energy of the shot during t (Figure 1):

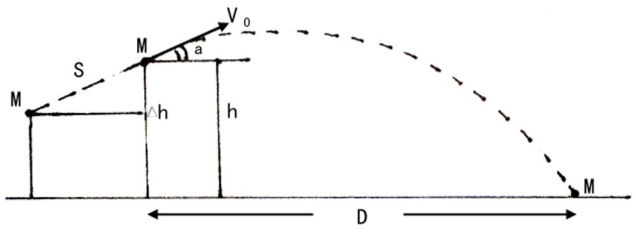

Figure 1 - Movement of shot putting.

$$W = \Delta E = \frac{mv^2}{2} + mg\Delta h$$

where ΔE denotes the change of energy of the shot during t, m the mass of the shot, v the speed of release, g the gravitational acceleration, and Δh the change of height of shot during t.

The athlete's strength exerted on the shot can be calculated as follows:

$$F = \frac{W}{S}$$

where S is the distance that the shot traveled during t.
With the kinematic parameters measured in this study, the average output of the athlete in power and strength was obtained.

RESULTS AND DISCUSSION: Figure 2 shows the trends of the average power and strength of the athletes with different weight selected. Both were increased with the increase of the weight from 4 kg, and reached the peak when the weight was between 6 and 7.26 kg. Then, with the increase of the weight, the power continuously increased, whereas the strength maintains unchanged.

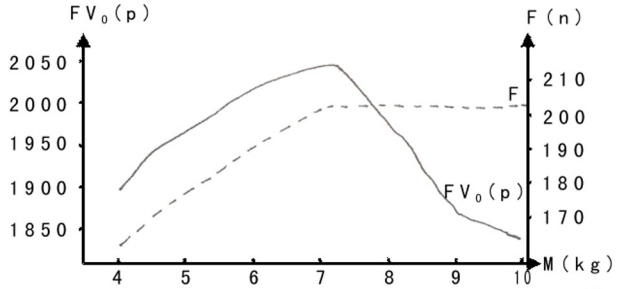

Figure 2 – The power and strength output across weight.

CONCLUSION: The power and strength output across weight showed different pattern. A weight between 6 and 7.2 kg is likely to result in the greatest power output in elite female shot-put athletes.

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