BIOMECHANICAL ANALYSIS OF THE SNATCH TECHNIQUE OF ELITE MALES IN TAIWAN

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The study compared two-dimensional snatch parameters of Taiwan elite males with International athletes by two-dimensional snatch parameters. Two males who were good Weight Lifting athletes in Taiwan were analyzed through PEAK motion analysis system to obtain kinematic data of the bar bell and human body. The result we found out as follows (1) The maximum velocity of barbell raising of this study was from 2.049 m/s to 2.124 m/s. (2) The barbell speed ratio of the first and second pull of male lifters of this study was from 1.07 to 1.47. (3) The percentage of barbell height to the lifters' height of females lifters was 73% to 74% (4) The vertical dropping velocity of gravity of body of this study was 203.1 m/s to 205.7 m/s.

KEY WORDS: snatch technique, weight lifter, kinetic analysis

INTRODUCTION: Weight lifting needs a lot of power and technique. It is also an item that can get great achievement for Taiwan in Olympic games. Many scholars had ever discussed the technique of the item including the maximum velocity of barbell raising, the ratio of barbell velocity during the first-pull period and the second-pull period, the ratio of the height of barbell lifted and the vertical dropping velocity of body center of gravity. The purpose of study is to try to find out the shortcoming of Taiwan elite males through comparing two-dimensional snatch parameters of Taiwan elite males with International athletes. We hoped these results could help Taiwan elite male weight lifters to improve their performance.

METHODS:

Subjects: The best record of each subject on a National event held in Taiwan were recorded. Related personal characteristics of lifters are shown in Table 1. The experiment was held in laboratory. After several easy trial, the subjects started to lift weight we had discussed with their coaches before several days ago. They kept trying until they lifted successfully and the successful trials were recorded.

Table 1 Related characteristics of lifters.

Lifters	A	B
Ages	23	20
Height (cm)	172	169.4
Weight (kg)	96	85
Best record (kg)	132.5	137.5
Experiment Weight (kg)	120	112.5

Determination of the phases of snatch pulling: In this study, snatch pulling was divided into two phases. Definitions were as follow:

1.The first pull: from the barbell lift-off until the first knee extension peak. (Figure 1 and Figure 2).

2.The second pull: the first maximum knee flexion to the second knee extension peak. (Figure 1 and Figure 2).

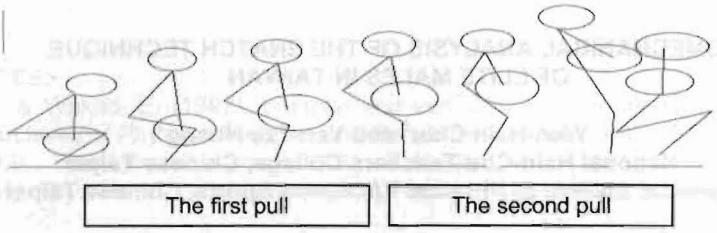

Figure 1 Determination of the phases of snatch pulling (1).

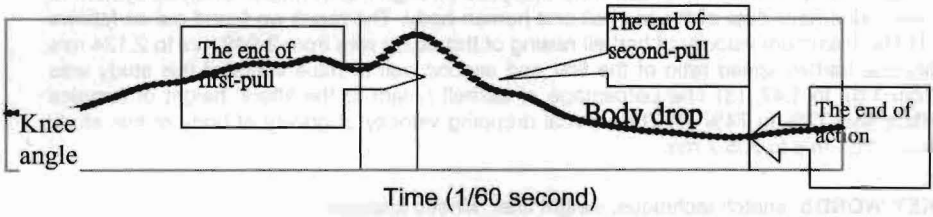

Figure 2 Determination of the phases of snatch pulling (2).

Data collection: One video camera (Panasonic AG-456) operating at 60 Hz was used to record snatch lifting. The camera is placed 10m from the left side and perpendicular to sagittal plane of the lifter (Figure 3).

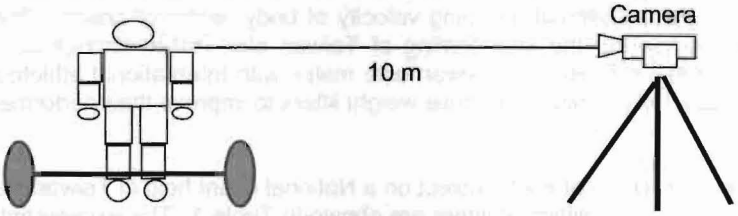

Figure 3 Arrangement of camera.

Data treatment and analysis: After filming lifters' movement by the Panasonic AG-456 video camera, the Direct.Linear Transformation technique was used for the two-dimensional coordinates and the Peak motus Version 7.0 software package was used to get kinematic parameters of gravity of body center and barbell with a second-Butterworth digital filter (cut-off frequency: 6 Hz) to reduce noise.

Table 2 showed all variables were analyzed in this study. In barbell kinematic parameters, bar's left side end (Figure 2) was used to represent the center of barbell (Garhammer, 1991). The displacement and velocity variables of barbell were calculated.

Table 2 Definitions of parameters.

Classification	Variables	Unit
Barbell kinematic	Maximum velocity of barbell raising	m/s
Parameters	Ratio of barbell velocity during the first-pull period and the second-pull period	m/s
	Ratio of the height of barbell lifted	m
Gravity of body	Vertical dropping velocity of gravity of body	m/s

RESULTS AND DISCUSSION:

Maximum velocity of barbell raising: If the athlete could had faster maximum velocity of barbell raising, he could utilize the speed to raise the barbell up easier. The maximum velocity of barbell raising of this study was from 2.049 m/s to 2.124 m/s. (Table 3)

Garhammer (1985) found out the maximum velocity of barbell raising of Olympic games winner in 1984 could reach to 2.10 m/s. Bauman (1988) also found out maximum velocity of barbell raising of world cup winner in 1985 could reach to 1.88 m/s. The result was close to Garhammer' s research and faster than Bauman's research.

Table 3 Maximum velocity of barbell raising.

Subject	first-pull period (m/s)	second-pull period (m/s)
A	1.386	2.049
B	1.911	2.124

Ratio of barbell velocity during the first-pull period and the second-pull period: Because the ratio of barbell velocity during the first-pull period and the second-pull period represented the steady and smoothness of the lifting process. So it must be low. The ratio of this study was from 1.07 to 1.47 (Table 4). Bauman (1988) found out the ratio of barbell velocity during the first-pull period and the second-pull period of world cup winner in 1985 was 1.270. The result showed that the ratio of barbell velocity during the first-pull period and the second-pull period of subject A was too larger than Bauman's research (1988).

Table 4 Ratio of barbell velocity during the first-pull period and the second-pull period.

Subject	first-pull period (m/s)	second-pull period (m/s)	ratio
A	1.386	2.046	1.47
B	1.911	2.046	1.07

Ratio of the height of barbell lifted: The ratio of the height of barbell lifted represented the height of the barbell. Therefore the higher you lifted the barbell, the harder you caught it when it dropped. The ratio of this study was from 0.67 to 0.73 (Table 5). Burdett (1982) pointed out the ratio of the height of barbell lifted of the athlete of world level was only 0.62. The result showed that the ratio of the height of barbell lifted of subject A and subject B was too larger than Burdett's research (1982).

Table 5 Ratio of the height of barbell lifted.

Subject	ratio
A	0.73
B	0.74

Vertical dropping velocity of gravity of body: The vertical dropping velocity of gravity of body represented whether you were already to catch the barbell. Therefore the faster your vertical dropping velocity of gravity of body was, the more time you have to prepare to catch the dropping barbell. The vertical dropping velocity of gravity of body of this study was 175 m/s to 183.9 m/s. (Table 6) Garhammer (1985)found out the vertical dropping velocity of gravity of body of Olympic games winner in 1984 could reach to 2.18 m/s. The result showed that the vertical dropping velocity of gravity of body of subject A and subject B was slower than Garhammer's research (1985).

Table 6 Vertical dropping velocity of gravity of body.

Subject	Vertical dropping velocity of gravity of body (m/s)
A	205.7
B	203.1

CONCLUSION: According to the result, the shortcoming of elite Weight Lifting males in Taiwan we found out as follows (1) The maximum velocity of barbell raising of subjects in the study was close to the one of the best athlete of weight lifting in the world. (2) The ratio of barbell velocity during the first-pull period and the second-pull period of one subject was too high. (3) The ratio of the height of barbell lifted of the two subjects was too high. (4) The vertical dropping velocity of body center of gravity and barbell of the two subjects was too slow. From the result, we believe elite Weight Lifting males in Taiwan could achieve great

advancement. The coach could also consult the result to help athletes improve their technique.

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