

BIOMECHANICS ANALYSIS OF SNATCHING SKILLS IN WOMEN TOPNOTCH WEIGHT LIFT - A CASE STUDY

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This study analyzed the biomechanics characteristics for a Chinese subject's 120 kg snatch skills act mainly through photographing measuring. The result showed: the barbell vertical changes were apparent, the barbell's vertical speed reached its maximum of 1.98 m/s when the barbell was 0.72 s away up the ground, and the barbell reached its highest point of 1.05 m when it was 1.0s away up the ground. It was concluded that the subject's skill showed the characteristic of quick breaking pull.

KEY WORDS: snatch, breaking pull, barbell vertical speed

INTRODUCTION: In the recent years, weight lifting in China has witnessed rapid improvements. Satisfactory results have been obtained in the world matches. Woman lifter Sun Tianni continuously broke the world records and won a gold medal in the Eighth National Games. Nevertheless, taken as a whole, Chinese lifters' snatch levels are comparatively low, which greatly influence the total results of weight lifting. Therefore, in order to improve the capacity to compete in the world and achieve the goal of winning the gold medals in Sydney Olympic Games, it is quite necessary to make a biomechanical analysis of snatch skills. After the analysis, the indexes concerned can be given in the every stage of snatch, which will supply weight lifting scientific training with evidences.

METHODS: Sun Tianni who won the 70 kg champion in the Eight National Games in 1997 was the subject of this study. Focus was mainly put on her snatch skills of the second 120 kg lifting. Two cameras were placed respectively at the frontal side and lateral side (left) with the photographing speed of 25 pictures per second, and analytical pictures intervals 0.02 seconds. Skills indexes acquired in every lifting stage were videotaped. Fixing in the three dimensional coordinate scale frame, the subject was viewed with three axis with X axis pointing from the left to right, Y axis from down to up and Z axis from front to back. The Bewegungs Analysis System software was used to make photos analysis and data wave filtering was applied to smooth the data at cut-off frequency 4 Hz.

RESULT AND ANALYSIS:

The Change of Barbell Vertical Speed.

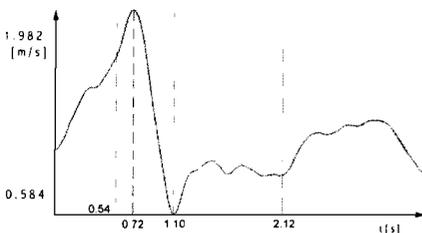


Figure 1 - The change of barbell vertical speed against time.

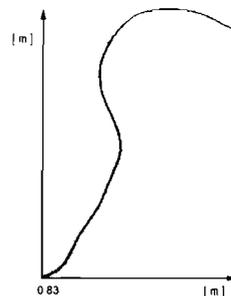


Figure 2 - locus of barbell in Y-Z plane.

Figure 1 illustrates the characteristics of barbell vertical speed in the whole process. The speed increased gradually to its maximum when the barbell raised up to the breaking pull end without any (which is not the case with most lifter). This showed that the subject directly brought the barbell with continuous force instead of making any adjustments. The continuity, smoothness, and harmony in her lifting and breaking pull stage constituted the good characteristics of skills.

The barbell speed reached its maximum of 1.98m/s when it was 0.72 seconds away up the ground. Squatting and propping stage came after the end of breaking pull. When the barbell ascended 0.28 seconds with inertia, the vertical speed decreased till zero. Then the barbell descended quickly and reached its maximum of 0.58m/s in the opposite direction after 0.1 seconds. Squatting and propping stage witnessed undulate changes in the vertical direction, which was different made two "the reverse motion" while the subject made three. We maintain that more strength was consumed because of more speed rises and falls, which would be unfavorable to the next act. When the barbell was 2.12 seconds away up the ground, the subject stood up at nearly constant speed except the slow acceleration at the beginning and the slow speed decreasing in the end.

The ascending speed in vertical direction that reaches 1.98m/s is extremely rare according to reference materials. The fact that Sun Tianni, the world-class player in this scale, can reach this maximum speed in the time of 0.72s (with breaking lift time 0.18s) indicates that her speed of lifting the barbell and explosive force are great and that her skill is almost perfect. The distinguishing features of her skill can be applied to guide weight lifting training.

The Change of Barbell Locus. As shown in Figure 2, the locus of the barbell followed a shape of letter "s" but the changes lied behind the vertical lines (the barbell is just away up the ground). The barbell took 1.00 second to reach its highest point of 1.05 meters, the time was about 0.04 to 0.06 seconds longer than the Olympic players of whom John Garhammer made a research. The barbell descending range was 9 cm and the barbell descended at its maximum speed when the descending range was 4 cm.

The Motion Characteristics at Barbell Lifting

Table 1 Characteristics of Bringing the Barbell, Breaking Pull, and Ascending Stages

	time	barbell ascending height (cm)	shoulder joint ascending and descending(m)	max vertical speed(m/s ²)	max vertical acceleration
bring barbell	0.54	43	43	1.32	3.57
Breaking pull	0.18	30	27	1.98	5.47
Ascending	0.28	32	-34	1.98	10.12

As shown in Table 1, the subject's breaking pull time was 0.18 seconds, which nearly accorded with that of 1994 year's champion. Her breaking pull was quick and maximum vertical speed was 1.98 m/s. The barbell ascending time was 0.28 seconds and the speed decreased obviously after ascending 0.14 seconds. The acceleration reached -10.12 m/s^2 (negative means the opposite direction of movement), with the duration about 0.02 seconds. The characteristics of using strength in the barbell inertia ascending stage lie in that the beginning witnessed continuous upwards pulling force, which gradually decreased, and the barbell nearly moved in the way of projectile. Temporary strength downward appeared after ascending about 0.14 seconds and the acceleration exceeded the gravity acceleration. At this point, the lifter swung the forearm and turned over the wrists. The temporary strength downward could influence the barbell's ascending height. The acceleration reached 9.4 m/s^2 before turning over the wrists and the barbell approached to projectile motion, which showed she swung the forearms and turned over the wrist at the appropriate time. Both the barbell and shoulder joint ascended 43 cm in the stage of bring the barbell. In the stage of breaking pull, the barbell ascending range was a little wider than that of shoulder joint. The barbell ascended 32 cm and the shoulder joint descending range was 34 cm in the stage of inertia ascending. The barbell was under the shoulder 0.14 seconds before the inertia ascending

stage, and above the shoulder after ascending 0.14 seconds. All these conformed to the time explained above in turning over the wrists.

Table 2 Knee Angle and Hip Angle Changes at the Key Time

	before breaking pull	after breaking pull	after squatting and propping
knee angle	150°	136°	57°
hip angle	116°	206°	64°

The change of angle at the key time in fulfilling the act. The knee angle refers to the included angle between the thigh and the shank, white the hip angle to that between the trunk and the thigh. Before breaking pull, the subject's front knee angle decreased from 120° to 115°, that is, she crooked the knees again to prepare for the breaking pull. After the squatting and propping, the body remained in the state of deep squatting, and both the knee angle and hip angle were harrow.

CONCLUSION:

1. The subject shows the characteristics of quick breaking pull. The breaking pull time was 0.18 seconds and the breaking pull act was continuous and harmonious.
2. The barbell locus takes the shape of letter "s" .The maximum height was 1.05 meters and the descending range was 9 com.
3. Improvement in the stage of squatting and propping is needed.

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