A Comparison of Performances by Women at the 1987 and 1998 World Weightlifting Championships

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The performances by women in weightlifting (WL) have increased dramatically since the first women's world championship in 1987. This paper investigates the magnitude of increases in weight lifted, and related biomechanical parameters, from 1987 to the 1998 world championships. Power per Kg body mass (relative power) was one of the performance parameters compared due to the large values generated during the competitive lifts and the importance of developing power output capabilities utilizing (WL) training methods to improve performance in many other sports.

METHODS

The heaviest weight lifted in the snatch and clean & jerk by the gold medallist in each weight division were (1) filmed at 50 fps using a 16mm LoCam camera at the 1987 women's world WL championships, and (2) video taped at 50 Hz using a PAL video camera at the world competition in 1998. The 2D visual records were analyzed using a Graf Pen sonic digitizer or a Peak Performance video analysis system. Raw film data was smoothed using a five point moving arc method; video data was smoothed using an optimized cubic spline. These two methods produced equivalent kinematic parameters when compared using raw data for several lifts from the 1998 competition. Calculated power values include only the vertical work done while lifting the barbell. Competition weight divisions changed slightly from 1987 to 1998, so the lifts in the six most similar divisions were compared (1987: 48-52-56-60-67.5-75 Kg; 1998: 48-53-58-63-69-75 Kg). The average body mass of the athletes compared was 1.54 Kg heavier in 1998 compared to 1987. The analysis methods used have been described in previous publications and are summarized by Garhammer (A review of power output studies of Olympic and Power lifting. J Strength & Conditioning Research 7(2): 76-89, 1993.).

RESULTS

Table 1: Average value for parameters compared between six gold medallists from 1987 and 1998.

Category	Body (Kg)	Bar (Kg)	P1 (W/Kg)	T1 (s)	P2 (W/Kg)	T2 (s)	Vy (cm/s)	Y (cm)
1987 SN	58.79	76.7	16.3	0.74	29.7	0.20	204.0	103.5
1998 SN	60.33	97.2	17.5	0.83	39.5	0.14	196.3	100.7
1987 CL	58.79	99.6	16.8	0.78	29.4	0.17	159.2	82.2
1998 CL	60.33	118.8	16.4	0.87	34.0	0.14	151.3	80.2

Body = athlete mass; Bar = barbell mass; P1 = total pull relative power; T1 = time for P1; P2 = second pull relative power; T2 = time for P2; Vy = maximum vertical bar velocity; Y = maximum bar height.

DISCUSSION

From 1987 to 1998 the average snatch lift increased from 76.7 to 97.2 Kg (27%), and the clean & jerk increased from 99.6 to 118.8 Kg (19%). During this period relative power output during (1) complete pulls for both snatch and clean lifts changed little even though the duration of the pull for each type of lift increased by approximately 0.1 seconds (12%) in 1998; and (2) second pull power values increased 33% for the snatches and 16% for the cleans while the duration of the second pulls decreased by 30% for snatches and 18% for cleans in 1998. Maximum vertical bar velocities and heights decreased about 8 cm/s and 2 to 3 cm respectively for both lifts. These results indicate that the large improvements in performance are connected to changes in technique during the second pull. Additional analyses will compare the joint kinematics of the athletes during the pulling motion, along with stature and segment length differences, to gain a better understanding of the technique changes that have occurred.