Anthropometric Influences on Snatch Biomechanics of Women in the 71-kg Weight Class

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Summary

Limb lengths of women in the 71-kg weight class influence weightlifting technique of the snatch. Lifters with longer thighs had faster turnover times as well as shorter drop times and distances. Although anthropometrics did not influence performance, a fast turnover may enable earlier and more effective stabilization of the bar, which is generally considered a beneficial technical aspect.

Introduction

The snatch is a movement that requires strength and speed to successfully lifted a loaded barbell overhead in one swift movement. Associations between a lifter's anthropometrics and the load they lift (i.e., performance) have been previously studied in women [1,2]. Anthropometric variables were correlated with horizontal bar displacement only if lifters were grouped by weight category but not when grouped together across weight categories [2]. This suggests that analyses should focus on single weight categories at a time. The purpose of this study was to explore the relationships between anthropometrics within the 71-kg women weightlifters and barbell kinematics during the snatch in competition.

Methods

Successful snatch attempts of 13 women weightlifters in the 71-kg category were recorded at the 2024 USA National Championship. Eight digital cameras were positioned around the platform and recorded videos simultaneously at 120 Hz. Videos were processed with Theia Markerless software. Joint centers were calculated based on inverse kinematics in Visual3D. MATLAB was used to calculate segment length of the shank, thigh, total arm, and torso based on the distance between joint centers. Bar kinematic variables were calculated with MATLAB. Pearson correlations between segment length and biomechanical parameters were calculated using SPSS.

Results and Discussion

Shank, thigh, torso, and arm length showed no significant relationships with maximum barbell height or performance (Table 1). Thigh length did, however, exhibit a significant relationship with turnover time, catch time, and drop time (Table 1). Arm length had a significant relationship to max vertical velocity (Vmax) (r = 0.598, p = 0.031).

Without the confounding effects of body weight, segment length did not have a significant relationship to performance. Segment lengths, however, may influence biomechanical factors of the snatch that contribute to an individual's technique in the 71-kg women's weight class. Vmax generally increases with body weight [3], and is therefore expected to be similar for all lifters in the same weight class. The current findings, however, show lifters with longer arms exhibited a greater Vmax. This finding may indicate that longer arms could be advantageous, potentially counteracting the expected decrease in speed as barbell weight increases [4, 5].

Longer thigh lengths were associated with shorter turnover and drop times as well as shorter drop distances. Shorter turnover times are thought to be beneficial as they enable the application of an earlier upward force on the bar. In addition, a quick turnover may also allow for a greater margin of error by increasing catch time and catch distance to correct any technical deviations as the barbell is secured overhead.

Conclusions

Anthropometrics influence individual technical differences of women weightlifters in the 71-kg weight class, but may not influence overall performance (i.e., load lifted).

Acknowledgments

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References

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Table 1: Pearson correlation coefficients and corresponding p-values (r, p) between limb length and biomechanical parameters for the 71-kg women weightlifting category. Hmax: maximum barbell height; Performance: total load (kg) successfully lifted; Dist: distance. '*' indicates statistical significance.

	Hmax	Performance	Turnover Time	Catch Time	Drop Time	Drop Dist	Catch Dist
Shank	0.41, 0.17	-0.14, 0.65	-0.21, 0.49	0.22, 0.47	-0.21, 0.48	-0.38, 0.20	0.38, 0.20
Thigh	0.29, 0.33	0.12, 0.69	-0.60, 0.03*	0.60, 0.03*	-0.61, 0.03*	-0.74, 0.01*	0.74, 0.01*
Torso	0.22, 0.48	0.36, 0.23	-0.11, 0.71	0.13, 0.68	-0.11, 0.71	-0.06, 0.84	0.03, 0.91
Arm	0.52, 0.07	0.04, 0.90	-0.31, 0.31	0.28, 0.35	-0.30, 0.32	-0.30, 0.32	0.30, 0.32