ANGULAR MOMENTUM IN THE STRAIGHT TKATCHEV ON HIGH BAR

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KEY WORDS: gymnastics, video analysis, Olympic Games

INTRODUCTION: Angular momentum in the straddle Tkatchev was reported as part of a study by Arampatzis and Brüggemann, (2001). The Tkatchev is an interesting skill as it requires the gymnast to reverse the direction of rotation between the bar circling action (the longswing) and the flight phase from release until regrasp.

METHOD: Digital images of ten male gymnasts performing the straight Tkatchev were recorded using two 50 Hz digital video camcorders. The reconstructed data (3D DLT) were combined with customised inertia parametes to produce a seven segment planar model. Angular momentum of each segment about its mass centre ($H_s = I \cdot \omega$) and of each segment about the whole body mass centre ($H_0 = m \cdot \Omega \cdot r^2$) were summed over seven segments to obtain angular momentum of the gymnast about his body mass centre [$H_c = \Sigma(I_i.\omega_i + m_i.\Omega_i.r_i^2)$].

RESULTS: Table 1 presents mean and standard deviation release characteristics and flight angular momentum values for the ten gymnasts. Vertical velocity at release was 10% higher than reported by Arampatzis and Brüggemann (2001) for the straddle Tkatchev. The corresponding horizontal velocity values were identical. Angular momentum was surprisingly lower for the straight Tkatchev compared to the previously reported straddle (33.4 $kg \cdot m^2 \cdot s^{-1}$).

Table 1 Release parameters for the Straight Tkatchev

N=10	$CMvy_l$ ($m \cdot s^{-1}$)	$CMvz_l$ ($m \cdot s^{-1}$)	$CMvz_g$ ($m \cdot s^{-1}$)	Flight (s)	H_c ($kg \cdot m^2 \cdot s^{-1}$)	H_c (ss)
Mean	-1.99	3.38	-3.84	0.75	28.9	0.319
StDev	0.27	0.43	0.53	0.06	6.0	0.037

Key: CMvy & CMvz = horizontal (y) and vertical (z) velocity of the gymnast's mass centre at release (l) and regrasp (g). Angular momentum (H_c) in absolute and normalised units (straight somersaults, ss).

DISCUSSION: Either the additional flight time was sufficient to compensate for the reduced capacity to rotate or the skill has changed over the six years since the date of the previous analysis. More probably, the use of slightly different methodologies influenced the results. In the next phase of this ongoing research, straddle Tkatchevs from Sydney will be analysed to see if this angular momentum anomaly holds true.

CONCLUSION: Application of a common methodology, including normalisation, will facilitate improved comparison of angular momentum between straddle and straight Tkatchevs and inform the subsequent analysis of the preparatory longswing techniques employed by gymnasts to bring about the required change in direction of the angular momentum vector.

REFERENCES:

Arampatzis, A. & Brüggemann, G.P. (2001). Mechanical energetic processes during the giant swing before the Tkatchev exercise. *Journal of Biomechanics*, 34, 505-512.

Acknowledgement

The authors would like to thank the IOC Medical Commission and colleagues at Loughborough University, UK for their support in obtaining the Sydney video data.