Inter-Session Reliability of Load-Velocity Profile and Dynamic Strength Index (DSI) in Chinese Elite Judokas

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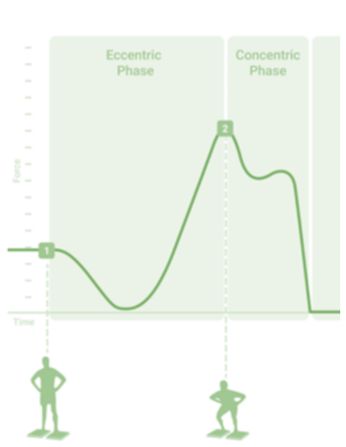
INTRODUCTION

Monitoring neuromuscular responses and recovery processes in elite athletes presents a significant challenge, as tests must be non-disruptive to training schedules—meaning they must be neither time-consuming nor physically demanding—while remaining reliable. To address this, we investigated, in a pilot study, the comparative inter-session reliability of dynamic strength index (DSI), which is the peak force ratio between the counter-movement jump (CMJ) and the isometric mid-thigh pull (IMTP) (1), and the multiple-point (MPM) and two-point (TPM) methods for evaluating the squat load-velocity curve (L-V).

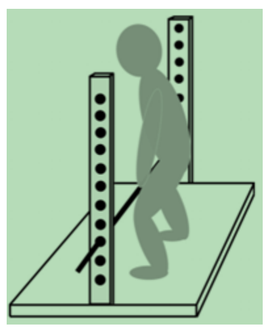
MATERIAL AND METHODS

Sixteen elite Chinese judokas (62.5% males, ages: 18.5 ±2.6 years, weight: 72.7 ±12 kg, body fat: 13.8 ±4 kg, muscle mass: 47.5 ±2.4 kg) participated in the study. The athletes attended the laboratory on five days, always at the same time of day to control for potential circadian effects. They completed three familiarization sessions followed by two testing sessions, with a 48 hours rest period between the test days. Athletes were instructed to refrain from training for 48 hours prior to testing and to maintain consistent fluid and dietary intake throughout the study. The two tests were conducted on the same day, with a one-hour rest interval between them. The order of the tests was randomized in blocks, with athletes paired based on their maximum strength levels from the IMTP to control for strength differences. Peak force (N) of CMJ and IMTP (with knee angles at 120º and hip angles at 145º) was measured using a 1000 Hz force platform (Kistler Instrumente AG, Winterthur, Switzerland). Additionally, the half-squat (with knees up to 90º) load-velocity curve was assessed using a linear encoder (Speed4Lifts SL, Madrid, Spain).



DSI

$$\frac{CMJ\ peak\ force}{IMTP\ peak\ force}$$

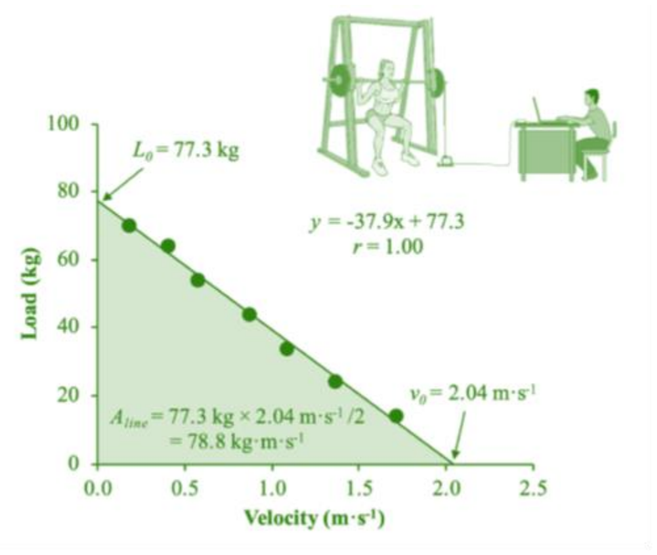


L0 = load at zero velocity

V0 = the velocity at zero load

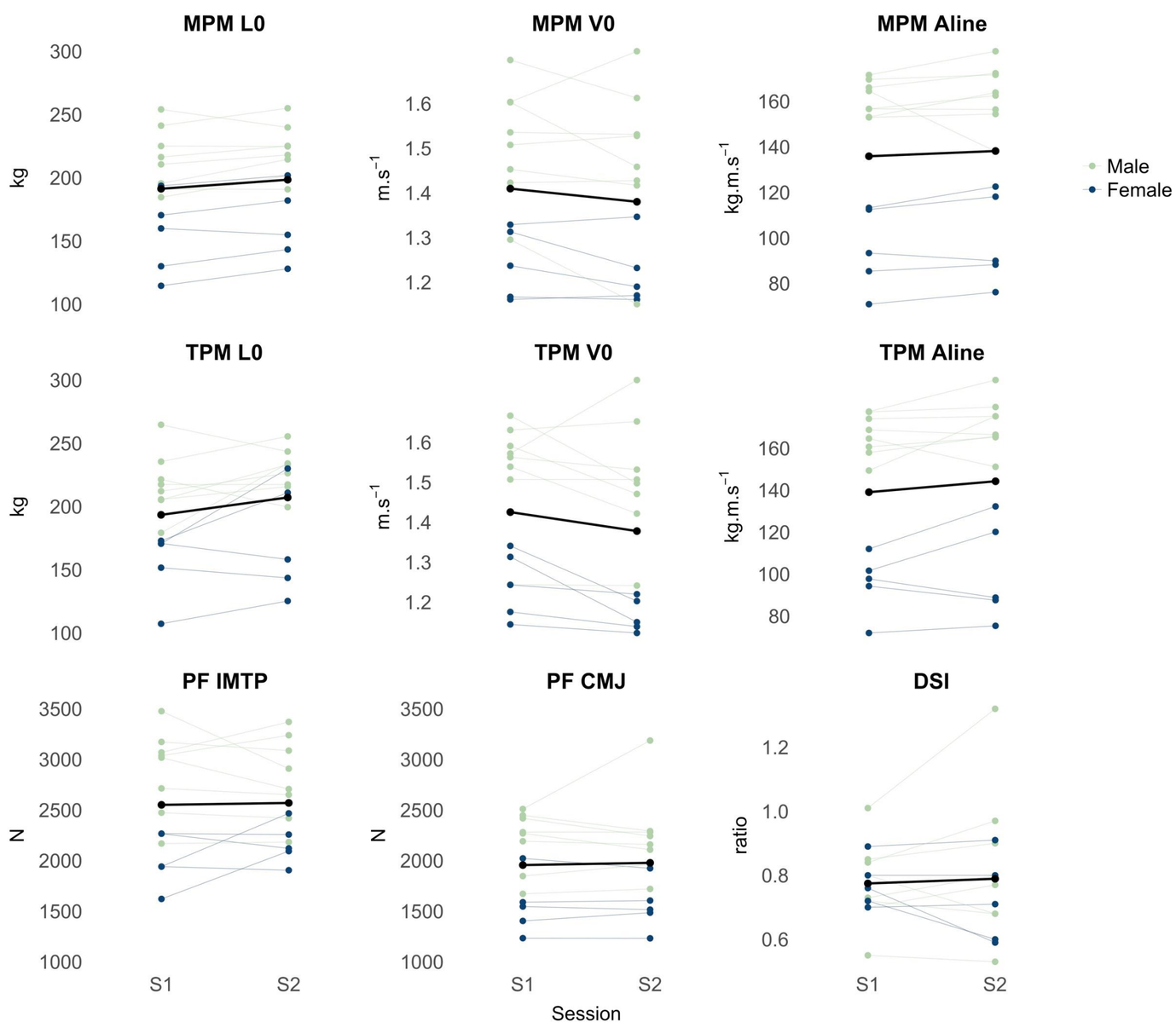
SL-V = Slope of the load-velocity (L-V) relationship

Aline = area under the line of the L-V relationship



RESULTS

High reliability was observed in the MPM load-velocity variables for L0 (CV= 3.48%, $ICC_{3.1}$ = 0.97), V0 (CV= 3.53%, $ICC_{3.1}$ = 0.92), SL-V (CV= 6.46%, $ICC_{3.1}$ = 0.90), and Aline (CV= 5.21%, $ICC_{3.1}$ = 0.96). For the TPM load-velocity variables, high reliability was found for L0 (CV= 9.44%, $ICC_{3.1}$ = 0.78), V0 (CV= 4.95%, $ICC_{3.1}$ = 0.88), and Aline (CV= 6.09%, $ICC_{3.1}$ = 0.95), but SL-V showed unacceptable reliability (CV= 14.29%, $ICC_{3.1}$ = 0.62). Both the peak force of IMTP (CV= 7.91%, $ICC_{3.1}$ = 0.85) and CMJ (CV= 7.47%, $ICC_{3.1}$ = 0.90) demonstrated high reliability, whereas the DSI variable had unacceptable reliability (CV= 11.11%, $ICC_{3.1}$ = 0.74). Individual data can be found in Figure 1 and 2.



DISCUSSION AND CONCLUSIONS

The most replicable test was those related with the L-V curve. Both IMTP peak force and CMJ peak force showed high reliability, while the DSI index demonstrated an unacceptable slope, though close to the CV and ICC cut-off thresholds. Despite this, DSI in this study exhibited better reliability than a similar test previously reported (2). Given that DSI is more time-efficient than the multiple load-velocity curve method, which sometimes required up to 12 loads to determine 1RM, and does not require weight adjustments between athletes like TPM, it proves to be a practical choice for frequent assessments in large groups. However, further research with larger sample sizes and a limitation on the maximum number of loads for MPM testing is recommended.

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