



NEUROMUSCULAR STRENGTH AND POWER FORCE-TIME CHARACTERISTICS OF NCAA DIVISION-I TRACK AND FIELD ATHLETES

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BACKGROUND

Research has shown that the Isometric mid-thigh pull (IMTP) significantly correlates with 0- to 5-m sprint performance in male athletes (1). Evidence suggests the IMTP is a viable option for practitioners and researchers to use to profile athletic ability. Isometric strength can have a sizable influence on 0- to 5-m time (2). Based on the literature, and in collaboration with The University of Kansas Track and Field team, this project was organized.

PURPOSE

The purpose of this study was to analyze force production characteristics of collegiate track and field athletes via the isometric midthigh pull (IMTP) and countermovement jump (CMJ) test.

METHODS

12 (male; n=4, mean±SD; height=180.34±1.55cm; weight=85.03±16.44kg, and female; n=8, mean±SD; height=168.05±5.36cm; weight=66.22±4.79kg) NCAA Division-I track and field athletes participated in this study. Athletes performed 3 trials of CMJ's then following a standardized dynamic warm-up, athletes performed 2 maximal IMTP on a Hawkins Dynamic dual force plate system. Max jump height and peak forces were recorded to examine absolute and relative force production characteristics. An independent samples T-test was performed on all variables recorded by the dual force plate system and the Shapiro-Wilks test was also conducted to confirm normality. The priori alpha level was set at 0.05 for all analyses.

RESULTS

- Significant differences were found in peak force (p=0.002), peak force at 50ms (p=0.042), and percent of max force at 50ms (p=0.01).
- Significant differences were found in peak braking force (p=0.005), peak propulsive force (p=0.0001), and net impulse 0-50ms (p=0.034).
- Jump height did not show significant differences between sexes.

CONCLUSIONS

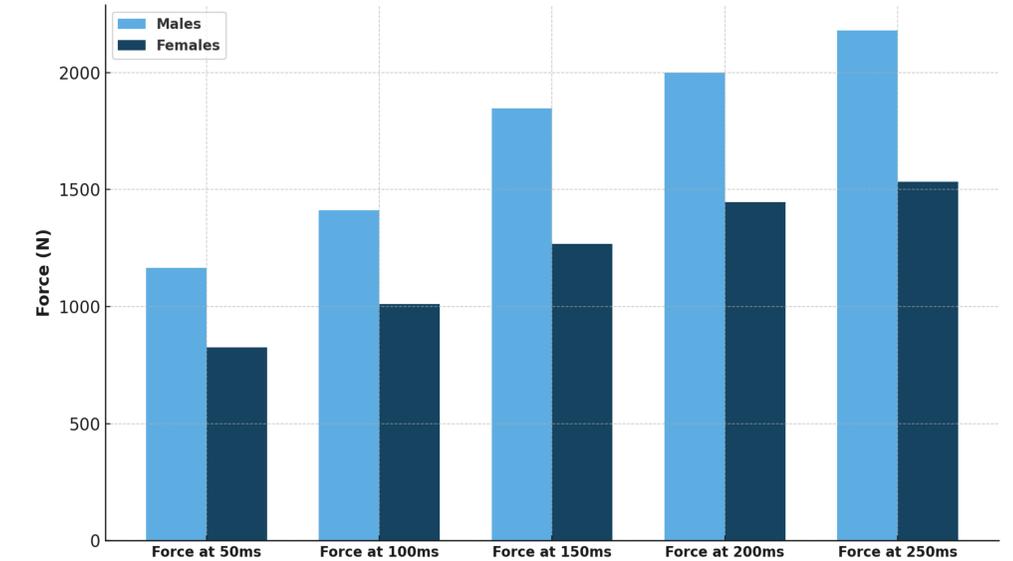
Within this cohort, males produced greater isometric force early (50ms) and absolutely. However, the other time intervals showed no significant difference between sexes and jump height showed no significant difference. Recommendations from the data may suggest performance coaches to prioritize initial reactive strength for the female athletes and maximal force production of both groups in relation to their body mass.



Table 1. Descriptive statistics, means and standard deviations ($\bar{x} \pm SD$), for males and female force characteristics.

Variable	Males	Females	p
Peak Force IMTP	3067.5 ± 655.6*	1901.1 ± 152.1	0.002
Force at 50ms	1380.0 ± 296.7*	813.9 ± 94.3	0.042
Force at 100ms	1573.8 ± 342.6	967.3 ± 168.1	0.120
Force at 150ms	1841.0 ± 595.1	1123.5 ± 244.7	0.060
Force at 200ms	2072.5 ± 679.9	1307.1 ± 274.9	0.046
Force at 250ms	2228.0 ± 584.2	1446.8 ± 258.1	0.120
Net Impulse [0-50ms]	14.24 ± 6.23*	4.36 ± 2.06	0.034
Time to Peak Force (s)	1.68 ± 0.14	0.69 ± 0.26	0.075
Max RFD [0-50ms]	8685.0 ± 3712.4	2812.5 ± 1733.8	0.150
Max RFD [0-100ms]	6377.5 ± 1735.3	2891.3 ± 1617.7	0.998
Max RFD [0-150ms]	6186.8 ± 2927.1	3003.3 ± 1604.4	0.054
Max RFD [0-200ms]	5875.0 ± 2621.9	3170.6 ± 1354.5	0.068
Max RFD [0-250ms]	5259.0 ± 1479.1	3095.0 ± 1030.7	0.298
% of Max @ 50ms	46.20 ± 11.37*	42.73 ± 2.02	0.010
% of Max @ 100ms	52.28 ± 10.54	50.59 ± 5.41	0.115
% of Max @ 150ms	59.70 ± 12.46	58.69 ± 9.38	0.282
% of Max @ 200ms	67.15 ± 14.58	68.24 ± 10.61	0.209
% of Max @ 250ms	72.78 ± 10.97	75.69 ± 9.71	0.617
CMJ Height (cm)	19.13 ± 5.61	13.22 ± 1.86	0.076
Peak Braking Force	2239.0 ± 587.0*	1454.4 ± 195.6	0.005
Peak Propulsive Force	2534.5 ± 801.5*	1531.8 ± 168.5	0.000
Peak Landing Force	4291.5 ± 1563.8	3146.6 ± 713.1	0.157

Figure 2. Comparison of male and female absolute force over time



PRACTICAL APPLICATIONS

With the utilization of force plate technology, the IMTP assessment provides valuable information regarding force production characteristics of collegiate track and field athletes, that highlights areas of potential strength and sport performance improvements.

REFERENCES

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