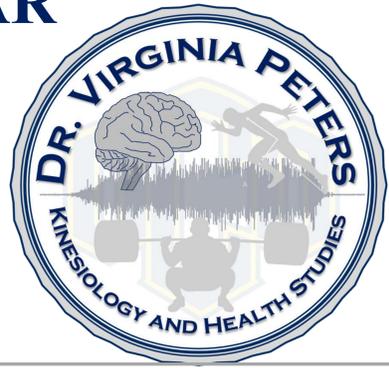




ARE ABSOLUTE AND RELATIVE ISOMETRIC FORCES DISSIMILAR BETWEEN MALES AND FEMALES WHEN PERFORMING ISOMETRIC MID-THIGH PULL CONTRACTIONS?



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INTRODUCTION

Rapid and maximal force characteristics of the lower extremity have been shown to differentiate a wide variety of performance metrics and athletic capabilities. The isometric mid-thigh pull (IMTP) has emerged as a reliable and valid method for assessing these characteristics, particularly peak force (PF) and rate of force development (RFD) (1). However, when assessing those variables, a multitude of published literature only reported absolute values, rather than also reporting relative information. The purpose of this study was to see if there are time specific differences in maximal and rapid force characteristics between males and females for either relative and/or absolute force values when performing an isometric mid-thigh pull.

METHODS

Thirteen healthy females (age = 22.38 ± 2.18 years, height 161.27 cm ± 30.22 cm, mass 70.04 kg ± 16.44 kg) and nine healthy males (age = 22.33 ± 0.71 years, height 183.98 cm ± 3.31 cm, mass 95.31 kg ± 10.88 kg) volunteered to participate in the study. Any upper or lower extremity injuries resulted in exclusion from the study. Each participant performed three IMTP at a knee joint angle between 125° - 145° degrees, three-minutes of rest were allowed in-between attempts. A wireless uniaxial dual force plate system was used for maximal and rapid force metrics. An independent t-test was used to assess differences between gender for relative force (peak force, PF50, PF100, PF150, PF200, and PF250) and absolute force (peak force, PF50, PF100, PF150, PF200, and PF250), and an alpha of 0.05 was used for level of significance.

Figure 1: Absolute Force

Variable	Sex	Mean (SD)	P-Value
PF at 50 ms (N)	Female	1066.62 (205.76)	P = 0.001
	Male	1719.11 (231.36)	
PF at 100 ms (N)	Female	1181.62 (258.58)	P = 0.001
	Male	1965.56 (319.34)	
PF at 150 ms (N)	Female	1267.92 (272.49)	P = 0.001
	Male	2110.11 (356.16)	
PF at 200 ms (N)	Female	1309.38 (260.68)	P = 0.001
	Male	2211.56 (406.14)	
PF at 250 ms (N)	Female	1365.15 (269.60)	P = 0.001
	Male	2220.22 (423.43)	
Peak Force (N)	Female	1556.69 (290.41)	P = 0.001
	Male	2488.56 (440.90)	

Figure 2: Relative Net Force

Variable	Sex	Mean (SD)	P-Value
PF at 50 ms (N · Kg ⁻¹)	Female	11.06 (0.81)	P = 0.008
	Male	12.9 (1.57)	
PF at 100 ms (N · Kg ⁻¹)	Female	12.26 (1.61)	P = 0.005
	Male	14.73 (2.07)	
PF at 150 ms (N · Kg ⁻¹)	Female	13.19 (1.99)	P = 0.010
	Male	15.81 (2.33)	
PF at 200 ms (N · Kg ⁻¹)	Female	13.64 (2.03)	P = 0.008
	Male	16.56 (2.60)	
PF at 250 ms (N · Kg ⁻¹)	Female	14.23 (2.12)	P = 0.027
	Male	16.59 (2.50)	
Peak Force (N · Kg ⁻¹)	Female	22.30 (2.80)	P = 0.024
	Male	26.10 (4.50)	

RESULTS

The analysis shows significant differences for all relative ($p = 0.001 - 0.027$) and absolute ($p = 0.001$) PF variables between genders. Where males had significantly greater peak force at specific portions of the force-time curve compared to females.

CONCLUSIONS

The present findings observed significant differences in relative and absolute force values for males compared to females when assessing one's IMTP. These results align with previous research (1) showing that males generally produce higher maximal and rapid force outputs, both absolutely and relatively. These sex-based differences may be influenced by neuromuscular factors.

PRACTICAL APPLICATIONS

These findings may be of importance for future research ideas. Specifically, future studies may want to assess different training styles such as resistance trained, athletes, and sedentary individuals. Understanding these differences can help coaches and practitioners tailor assessments and strength programs based on individual needs and baseline force production capabilities.

REFERENCES

1. Comfort, P., McMahon, J. J., Lake, J. P., Ripley, N. J., Triplett, N. T., & Haff, G. G. (2024). *Relative strength explains the differences in multi-joint rapid force production between sexes. PloS one, 19(2), e0296877.* <https://doi.org/10.1371/journal.pone.0296877>



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