

## INTRODUCTION

Strength and power assessments are helpful tools to screen for injury risk, physical preparedness, and performance in tactical athletes. While contemporary assessment tools, such as force plates, are gaining popularity, they may not be feasible for widespread implementation; therefore, there is value in assessments with traditional field-based equipment. However, there is limited evidence on the interrelationships of force plate and field-based measures of global strength and upper body power.

## PURPOSE

The purpose of this study was to identify relationships between the field-based assessments hand grip dynamometry and medicine ball toss; and vertical ground reaction force measurements of isometric mid-thigh pull and plyometric push up.

## METHODS

- Participants:** 12 physically active adults (10 M, 2 F, age:  $25.1 \pm 7.1$  years, height:  $176.8 \pm 9.5$  cm, body mass:  $82.0 \pm 11.4$  kg, measured mean  $\pm$  SD) were recruited for this study.
- Procedures:** Participants attended 2 sessions, each separated by at least 1 week apart. Sessions were either a contemporary force plate condition, or a field-based assessment condition, which were block-randomized.

### Contemporary Force Plate Assessments

- Isometric Midthigh Pull:** Participants completed the IMTP on portable force plates by pulling as hard as possible on a barbell against bar stops. Participants used a pronated grip. 3 trials were completed, with a 1 minute rest in-between.
- Plyometric Pushup:** Participants completed plyometric push-ups on portable force plates by starting in a high plank position, descending without the chest touching the plates, and then explosively pushing up off the plates. Participants completed 3 trials, with a 2-3 second rest in-between.

### Field-Based Assessments

- Handgrip Strength:** Participants sat on a chair, feet flat on the floor. Following, participants squeezed a handgrip dynamometer with max effort for 3 trials per hand, 1 minute rest between sets, alternating each time.
- Seated Medicine Ball Toss:** Participants laid on a 45 degree bench, and tossed a medicine ball (3.6kg) as far as possible for 3 trials, 30-second rest in-between.



Figure 1. Left: Bar stop setup with IMTP; top right: IMTP setup; bottom right: handgrip strength assessment

## RESULTS

- IMTP peak force was significantly correlated with dominant ( $r=0.846$ ,  $p<0.001$ ), and non-dominant ( $r=0.862$ ,  $p<0.001$ ) handgrip strength.
- Medicine ball toss distance was not significantly correlated with plyometric pushup peak force ( $n=11$ ;  $r=0.447$ ,  $p=0.168$ ), or peak power ( $n=8$ ;  $r=0.306$ ,  $p=0.462$ ).

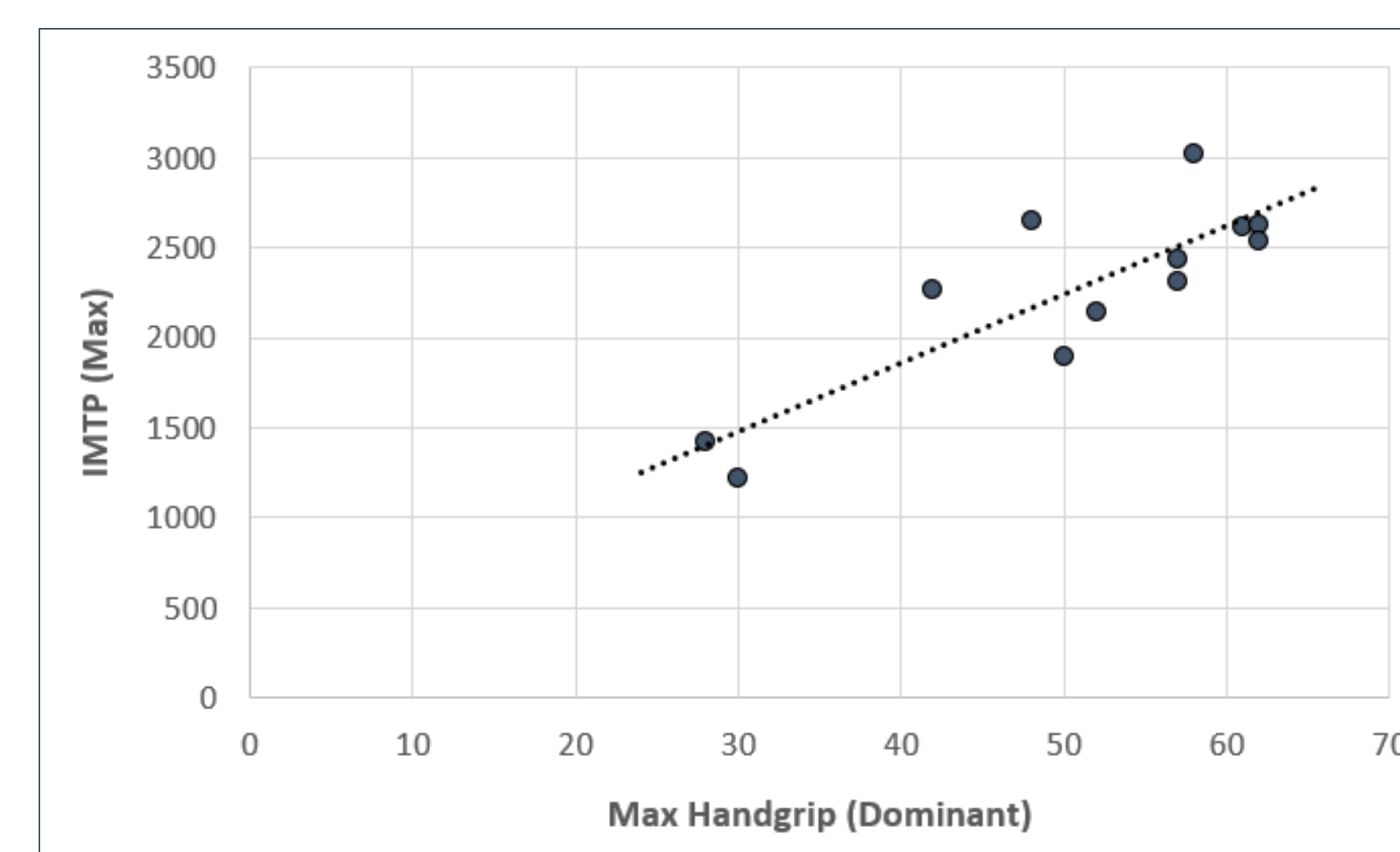


Figure 2. Scatterplot of IMTP and Handgrip, dominant hand.

## CONCLUSIONS

- Handgrip strength demonstrates strong correlations with the IMTP. Further research is needed to evaluate the influence of handgrip strength on IMTP performance.
- The seated medicine ball toss is not significantly correlated with plyometric pushup performance and one should exercise caution when comparing the results of the two tests.

## PRACTICAL APPLICATIONS

- Tactical strength & conditioning professionals should be mindful of what fitness assessment is most feasible for their population, and the pros and cons that exist.
- For measurements of total body strength, if force plate implementation is not feasible, the handgrip strength test correlates strongly with IMTP performance. However, the midthigh pull may be limited by handgrip strength, so caution must be used.
- For measurements of power, the plyometric push-up may not showcase the same outcomes as a seated medicine ball toss, therefore one will need to identify which is proper for their population.
- Professionals also need to consider that not all athletes can do a plyometric push-up, and that while the plyometric pushup has both an eccentric and concentric phase, the seated medicine ball toss only has a concentric phase in its' movement.

## ACKNOWLEDGEMENTS

Funding received from Office of Naval Research award # N0004-21-1-2686.

## REFERENCES

- Foulis, S. A., Sharp, M. A., Redmond, J. E., Frykman, P. N., Warr, B. J., Gebhardt, D. L., Baker, T. A., Canino, M. C., & Zambraski, E. J. (2017). U.S. Army Physical Demands Study: Development of the Occupational Physical Assessment Test for Combat Arms soldiers. *Journal of science and medicine in sport*, 20 Suppl 4, S74–S78.
- Lanham, S. N., Langford, E. L., Rochani, H., Melton, B. F., Rossi, S. J., & Abel, M. G. (2023). The Impact of Gloves and Occupational Tasks on Handgrip Strength in Structural Firefighters. *International journal of exercise science*, 16(4), 1087–1102.