



Validity and Reliability of a Novel Inertial Measurement Unit for Assessing Vertical Jump Performance

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INTRODUCTION

- Vertical jump (VJ) performance is a key component of many sports and high jumping ability has been correlated with successful athletic development (1-2).
- The countermovement jump (CMJ) is among the most popular jump variation used by sport practitioners (3).
- Currently, force plates (FP) are considered the 'gold standard' for assessing jump performance; however, they can be impractical for most athletic programs (4).
- Field-based alternatives exist; however, the reliability and validity are questioned in literature.
- Therefore, the purpose of this study is aimed to investigate the accuracy of a novel inertial measurement unit (IMU) device on the CMJ compared to the FP.

METHODS

- 50 (ht. = 181.2±12.3 cm; wt. = 78.0±14.3 kg) NCAA Division-III athletes from the University of Mary Hardin-Baylor volunteered for this study.
- IMU sampling at 500 Hz, was secured over midfoot of both feet using a velcro strap to minimize movement.
- While standing on FP, each athlete completed two CMJs separated by 30 seconds of rest. Athletes were instructed to achieve ~90° knee flexion and told to "jump as high as possible" while keeping hands on hips.
- Unless technically unsound, the second jump was used for analysis and JH, FT, and TOV were the metric of choice.

THIS NOVEL INERTIAL MEASUREMENT UNIT DEVICE WAS DEEMED VALID AND RELIABLE FOR ASSESSING VERTICAL JUMP PERFORMANCE

Variable	IMU	FP	ICC	r [p-value]
Jump height [cm]	33.4±9.6	33.8±9.7	0.993	0.986 [<0.001]
Flight time [sec]	0.516±0.08	0.527±0.077	0.992	0.994 [<0.001]
Takeoff velocity [m/s]	2.53±0.37	2.54±0.38	0.993	0.986 [0.002]

Table 1: Descriptive statistics for agreement between the IMU device and FP.

STATISTICAL ANALYSIS

- Independent t-tests were used to examine differences in each dependent variable between the IMU and FP system.
- Pearson product-moment correlation coefficient (r) for linear regression were used to determine the degree of association between the two testing modalities (IMU vs. FP) for each dependent variable and the intra-class correlation coefficients (ICC) to determine the magnitude of absolute agreement.
- The α level of $p < 0.05$ was used as a criterion for statistical significance.

DISCUSSION

- This IMU device utilized in this trial was shown to be valid and reliable in all three CMJ metrics compared to the criterion measurement (force plates).
- A secondary analysis in this trial validated the interrater agreement between the left and right IMU device (see QR below) showing the ability to produce accurate results with only one sensor.
- This device is valid and reliable for assessing VJ performance and neuromuscular fatigue.

PRACTICAL APPLICATION

These results deemed this IMU device a valid and reliable field-based tool to accurately measure jump performance in a practice setting due to the price, portability, simplicity, and efficiency.

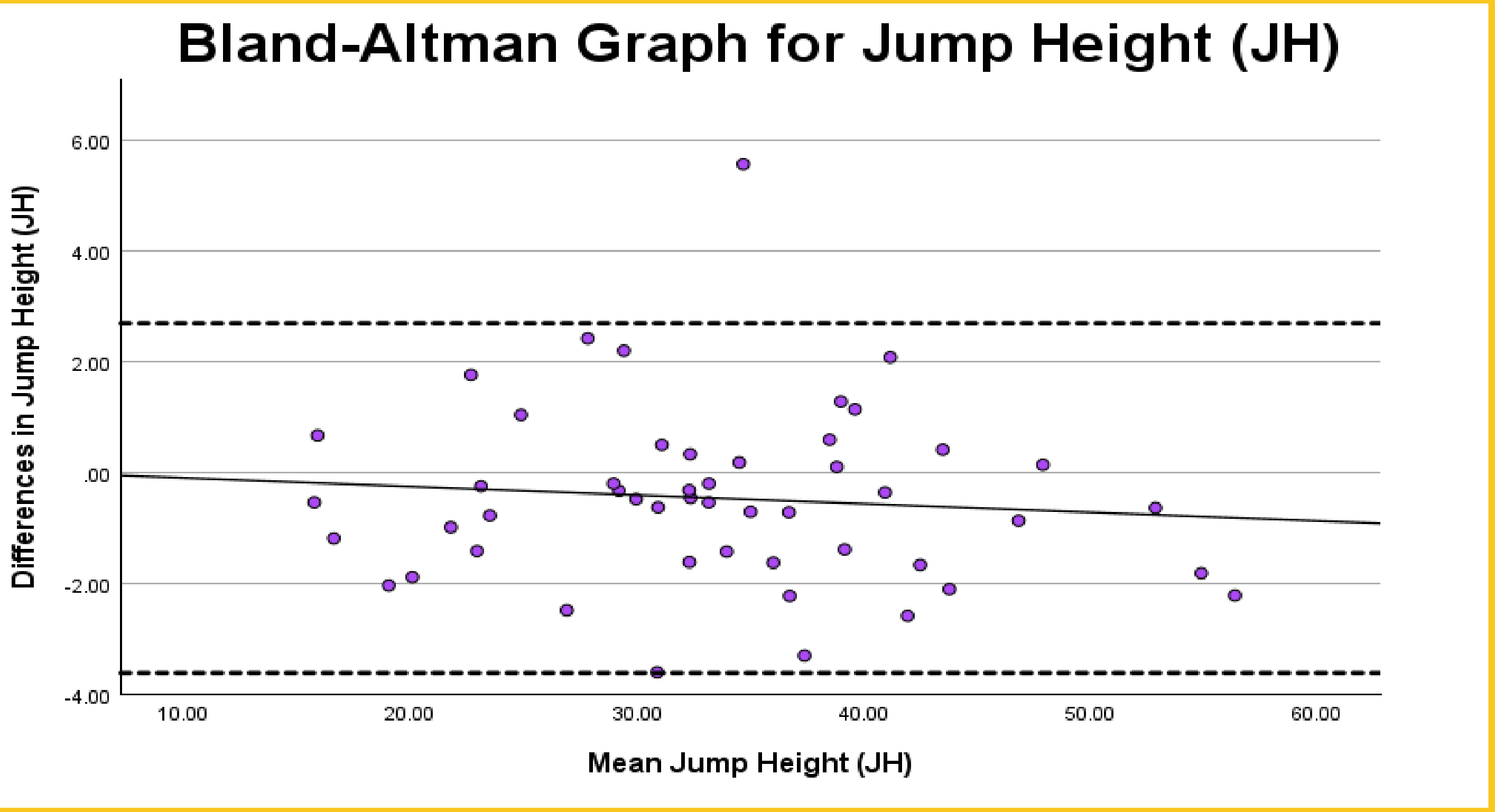


Figure 1: Comparison of JH between the IMU device and FP.

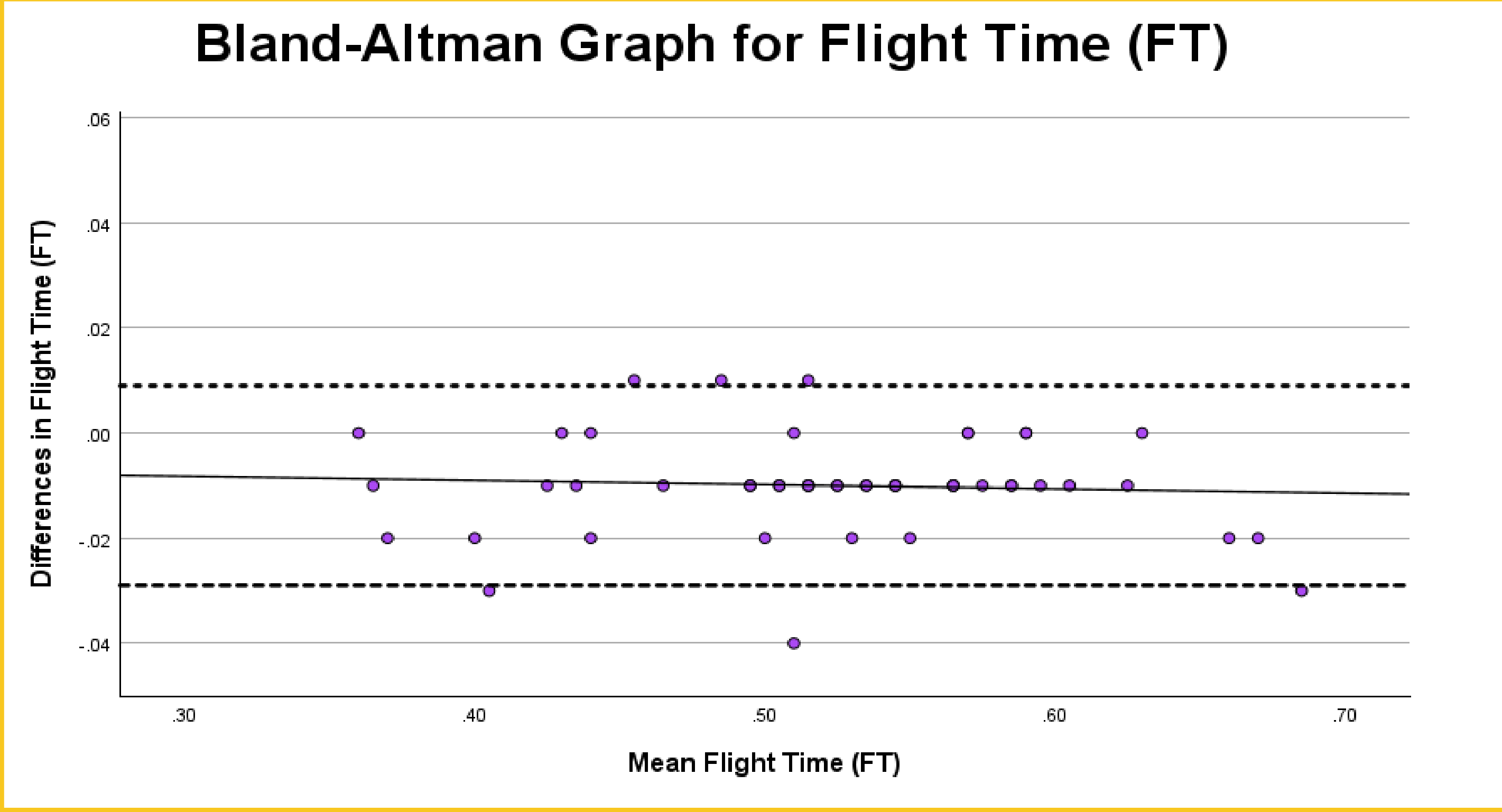


Figure 2: Comparison of FT between the IMU device and FP.

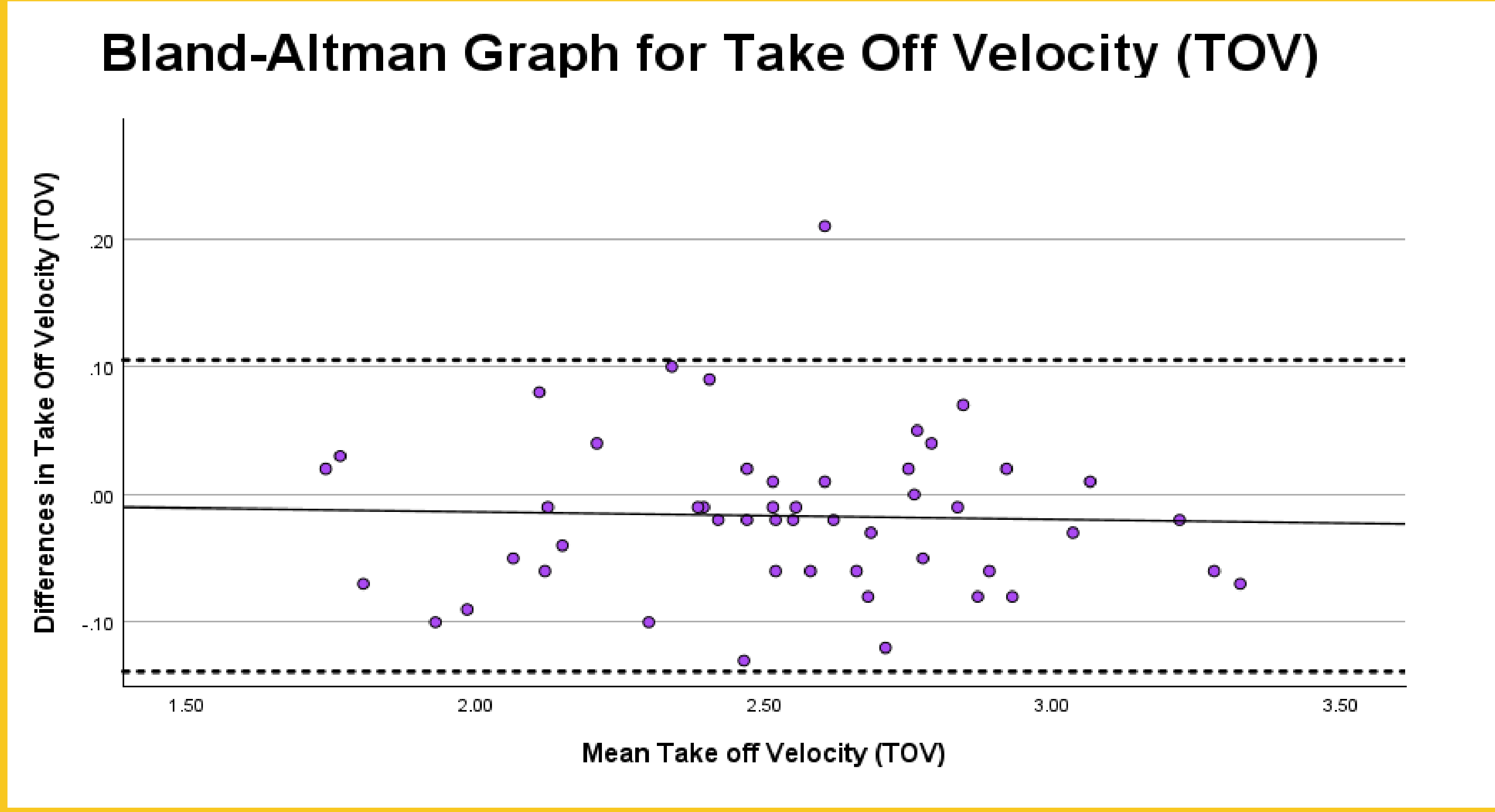


Figure 3: Comparison of TOV between the IMU device and FP.

SECONDARY ANALYSIS & REFERENCES



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