World Academy of Science, Engineering and Technology
International Journal of Sport and Health Sciences
Vol:18, No:08, 2024

# The Reliability and Shape of the Force-Power-Velocity Relationship of Strength-Trained Males Using an Instrumented Leg Press Machine

**Authors :** Mark Ashton Newman, Richard Blagrove, Jonathan Folland

**Abstract :** The force-velocity profile of an individual has been shown to influence success in ballistic movements, independent of the individuals' maximal power output; therefore, effective and accurate evaluation of an individual's F-V characteristics and not solely maximal power output is important. The relatively narrow range of loads typically utilised during force-velocity profiling protocols due to the difficulty in obtaining force data at high velocities may bring into question the accuracy of the F-V slope along with predictions pertaining to the maximum force that the system can produce at a velocity of null ($F_0$) and the theoretical maximum velocity against no load ($V_0$). As such, the reliability of the slope of the force-velocity profile, as well as $V_0$, has been shown to be relatively poor in comparison to $F_0$ and maximal power, and it has been recommended to assess velocity at loads closer to both $F_0$ and $V_0$. The aim of the present study was to assess the relative and absolute reliability of an instrumented novel leg press machine which enables the assessment of force and velocity data at loads equivalent to ≤ 10% of one repetition maximum (1RM) through to 1RM during a ballistic leg press movement. The reliability of maximal and mean force, velocity, and power, as well as the respective force-velocity and power-velocity relationships and the linearity of the force-velocity relationship, were evaluated. Sixteen male strength-trained individuals (23.6 ± 4.1 years; 177.1 ± 7.0 cm; 80.0 ± 10.8 kg) attended four sessions; during the initial visit, participants were familiarised with the leg press, modified to include a mounted force plate (Type SP3949, Force Logic, Berkshire, UK) and a Micro-Epsilon WDS-2500-P96 linear positional transducer (LPT) (Micro-Epsilon, Merseyside, UK). Peak isometric force (IsoMax) and a dynamic 1RM, both from a starting position of 81% leg length, were recorded for the dominant leg. Visits two to four saw the participants carry out the leg press movement at loads equivalent to ≤ 10%, 30%, 50%, 70%, and 90% 1RM. IsoMax was recorded during each testing visit prior to dynamic F-V profiling repetitions. The novel leg press machine used in the present study appears to be a reliable tool for measuring F and V-related variables across a range of loads, including velocities closer to $V_0$ when compared to some of the findings within the published literature. Both linear and polynomial models demonstrated good to excellent levels of reliability for SFV and $F_0$ respectively, with reliability for $V_0$ being good using a linear model but poor using a 2nd order polynomial model. As such, a polynomial regression model may be most appropriate when using a similar unilateral leg press setup to predict maximal force production capabilities due to only a 5% difference between $F_0$ and obtained IsoMax values with a linear model being best suited to predict $V_0$.

**Keywords :** force-velocity, leg-press, power-velocity, profiling, reliability
**Conference Title :** ICSBAP 2024 : International Conference on Sports Biomechanics and Athletic Performance
**Conference Location :** Montreal, Canada
**Conference Dates :** August 05-06, 2024