

Estimation of upper and lower extremity maximal muscle strength

- based on submaximal elastic resistance band test

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Introduction

Assessing muscular strength is important for physical therapists and other clinicians e.g. for evaluating performance and in rehabilitation. Maximal muscle strength testing using traditional equipment often causes high loads on joints and muscles and is therefore not always feasible. An alternative in muscular strength assessment is the elastic resistance band, which is already used extensively in clinical settings. Therefore it would be practical to use these for muscle strength assessment and subsequent muscle training.

Materials and Methods

Healthy adults (n=26) performed a maximal test (1 RM) to validate the ability of the submaximal tests to determine maximal muscle strength. Using a within-group repeated measures design, three submaximal test of 40%, 60% and 80% of 1 RM during 1) shoulder abduction, 2) shoulder external rotation, 3) knee flexion and 4) hip adduction, were subsequently performed on separate occasions (Figure 1). All tests were performed with a single elastic resistance band or a combination of bands of standardized length. Based on the three submaximal levels, associations between number of repetitions and relative intensity were modelled with both 1st and 2nd order polynomials to determine the best predictive validity.

Aim

To a) validate the use of submaximal intensity levels to estimate maximal muscle strength and b) verify the association between number of repetitions and intensity using submaximal elastic resistance bands.

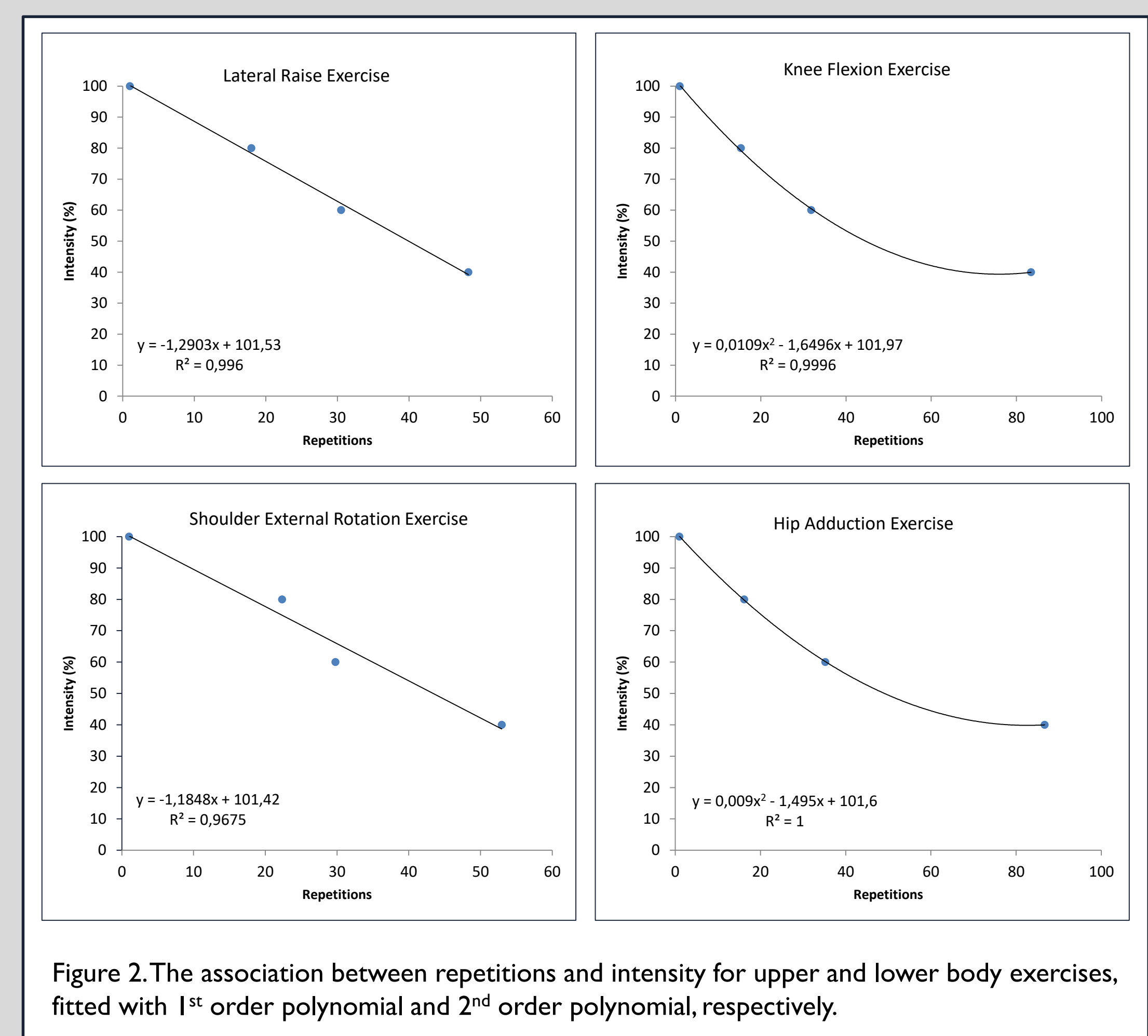
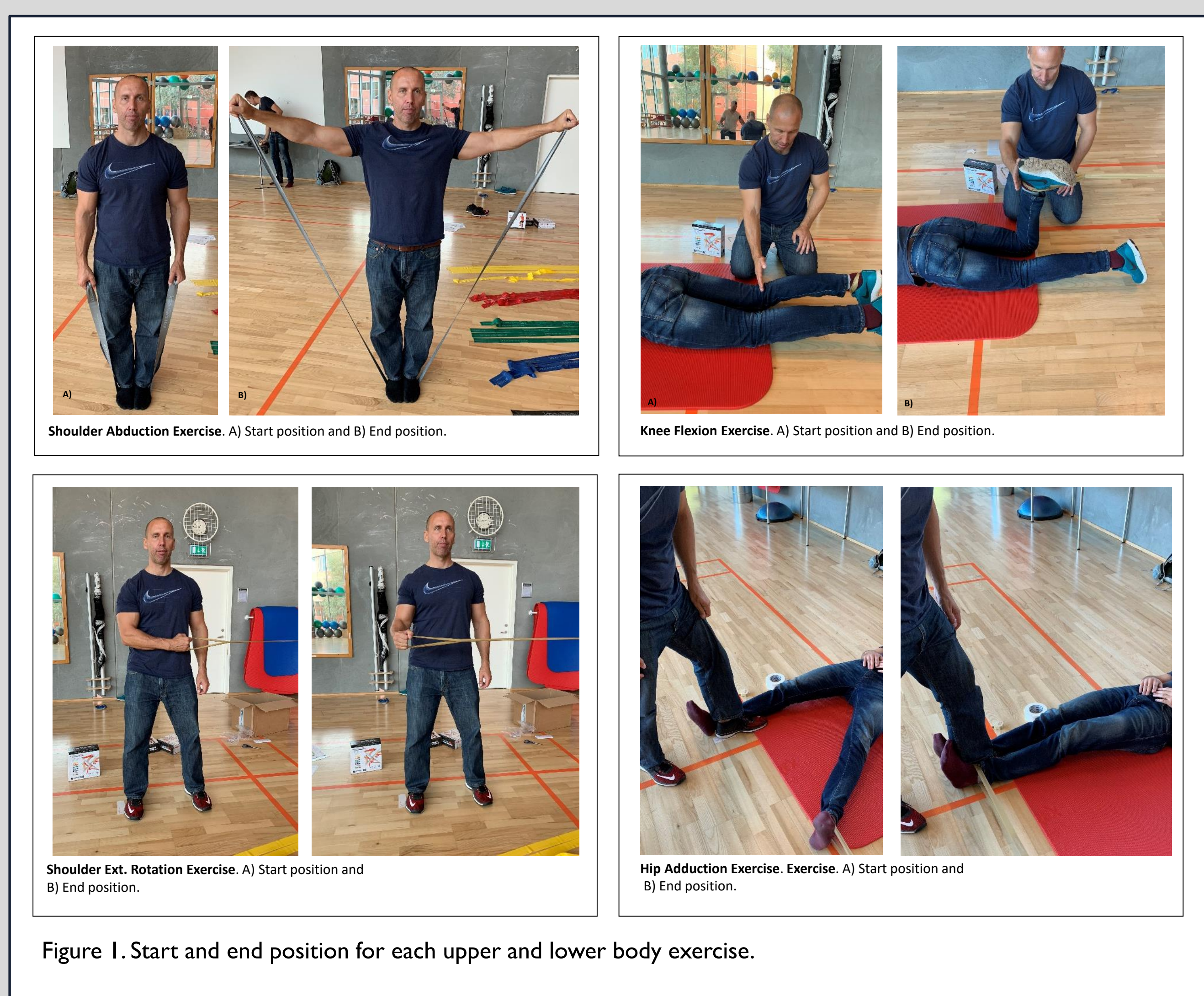


Figure 2. The association between repetitions and intensity for upper and lower body exercises, fitted with 1st order polynomial and 2nd order polynomial, respectively.

Results

All exercises showed a strong linear association between repetitions and relative intensity (Figure 2). Repetition range for each targeted intensity was established (Figure 3).



Conclusion

Using submaximal resistance with elastic resistance bands is a valid method to estimate maximal muscles strength.

The present study provides a useful tool to both a) estimate maximal muscle strength and b) to prescribe the desired intensity level of muscular training.

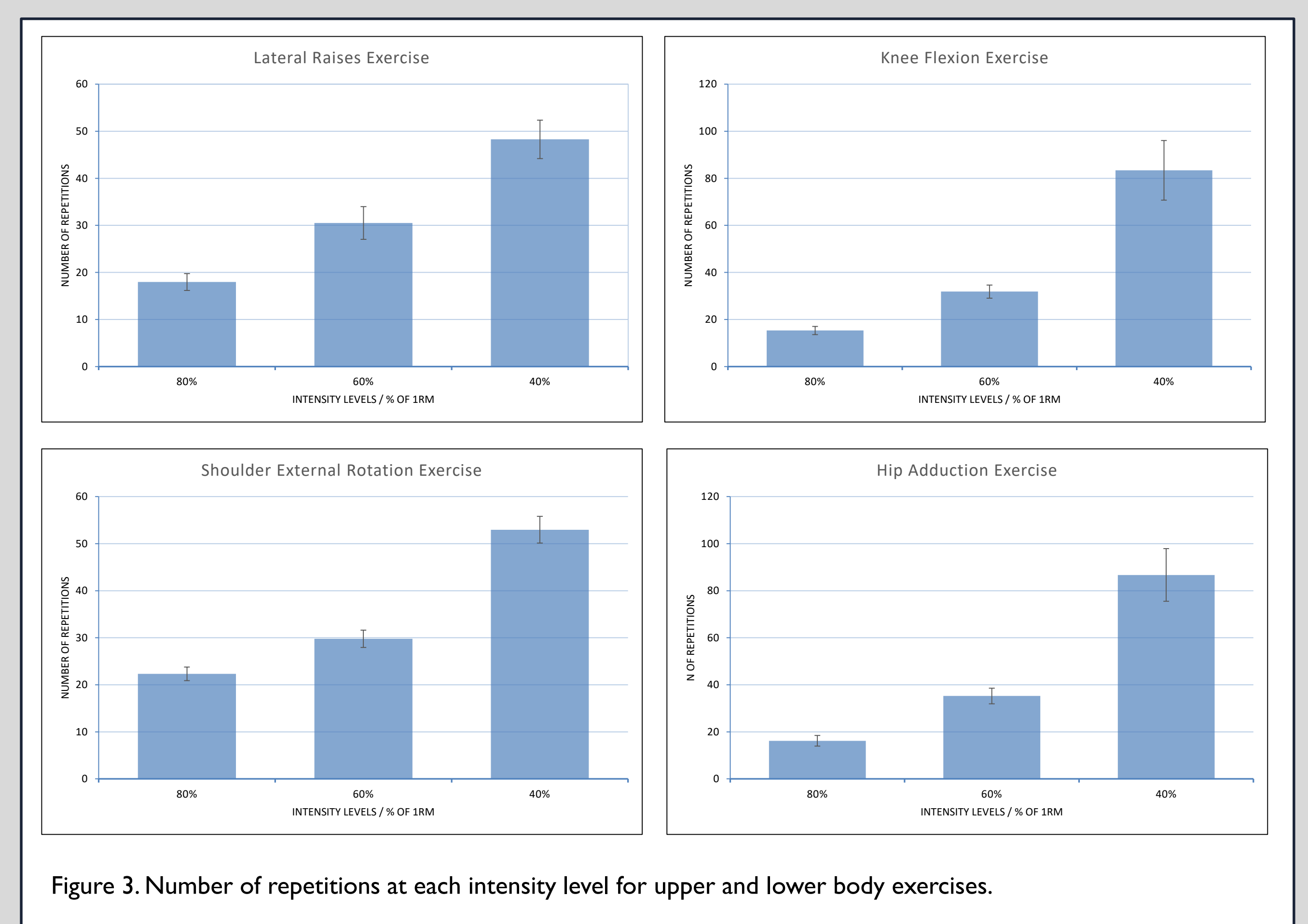


Figure 3. Number of repetitions at each intensity level for upper and lower body exercises.

Clinical Implications

Estimating maximal muscle strength through a submaximal test using elastic resistance bands is a valuable alternative for individuals who suffer from musculoskeletal pain or other discomfort that may prevent reaching true maximal strength levels. A practical approach would be to use the elastic resistance bands in the subsequent muscle training, with intensities and repetitions based on the guidelines provided by this study.