TITLE

The reliability and validity of a method for the assessment of sport rock climber's isometric finger strength

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ABSTRACT

Isometric strength of the finger flexors is considered to be one of the main physical determinants of sport rock climbing performance. We set out to determine the test-retest reliability and criterion validity of a low resource maximal isometric finger strength (MIFS) testing protocol that uses a pulley system to add or remove weight to/from a climbers' body. To determine test-retest reliability 15 subjects MIFS was assessed on two occasions, separated by a minimum of 48 hours. Body mass and maximum load was recorded on both occasions. Intra-class correlation coefficients (ICC) between visits for all variables were very good (ICC > 0.91), with small bias and effect sizes – particularly when expressed as a percentage of body mass (ICC = 0.98, 95% Confidence Interval 0.93 - 0.99). To determine the criterion validity of MIFS and climbing ability, data of 229 intermediate to higher elite climbers were compared. Pearson's product moment correlations demonstrated good agreement, again particularly between total load when expressed as a percentage of body mass and climbing performance (r = 0.421 – 0.503). The results illustrate the sensitivity of a simple test for the determination of MIFS in intermediate to height elite climbers from an ecologically valid, climbing specific test that only requires equipment found at most climbing walls. This low resource test protocol for the assessment of isometric finger strength has wide-reaching utility, for instance when assessing strength before and after a training intervention or when prescribing load intensities for exercises aimed at improving maximal finger strength.

KEYWORDS

Rock climbing; exercise testing; reliability; criterion validity; finger flexors

INTRODUCTION

The isometric strength of the finger flexors is considered to be one of the main physical determinants of sport rock climbing performance (3, 4, 10, 13). When attempting to ascending a route, climbers use the distal part of the fingertips to support their body mass on holds (either artificial resin holds indoors, or natural rock edges outdoors). Isometric muscular strength of the flexors and extensors of the fingers is required to maintain the hand position and contact with the hold (2). Thus, a successful ascent is reliant on a level of finger strength that is at least the same as - or exceeds - that required to support the climber's body mass on the holds available on the route they are attempting. It is unsurprising then that hand and finger strength has received considerable attention in the climbing literature.

Early research into the role of climber's finger and forearm strength employed handgrip dynamometry (7, 12), which involves an isometric squeeze action between the fingers and the base of the thumb. However, more recently it has been highlighted that using such methods lack specificity to the type of hand positions and muscular contractions that are required in climbing (17, 18). Instead, the isometric strength of the finger flexors is better represented through tests that use body (3, 14) and hand positions (2) more typically found in the sport, i.e. with 90- to 180-degree shoulder flexion and using only the distal part of the fingertips. Studies employing such methods provide evidence that a high percentage of variance in climbing performance can be predicted by a combination of hand and arm strength and endurance. For instance, Baláš, et al. (4) assessed 205 lower grade to higher elite level climbers grip strength, bent-arm hang, and finger hang, while controlling for body fat percentage, the volume of climbing and climbing experience, combined, these variables were able to explain 97% of the variance in climbing performance. Furthermore, differences between disciplines have also been reported, Fryer, et al. (10) found advanced male boulders (climbers who specialise in short, powerful routes close to the ground) to have significantly greater finger strength than advanced male sport climbers (specialising in longer, more endurance-focused routes using ropes for protection). As a consequence of its pivotal role in determining climbing performance, there is considerable interest in the assessment of isometric finger flexor strength from climbers and their coaches.

The reliability of methods for the determination of finger flexor strength has been presented by Baláš, et al. (2) using electronic scales with a data logger and by Michailov, et al. (14) using a custom made finger flexor dynamometer, known as the 3DSAC. Both methods demonstrated excellent test-retest reliability, with intra-class correlation coefficients of 0.88 to 0.94 (depending on the grip position) and 0.88 (without the fixation of the arm) for the scales and dynamometer, respectively. However, both of these methods require expensive (in particular the 3DSAC) specialised equipment that is rarely, if ever, found in climbing gyms. Consequently, there is a need for a low cost, easily implemented, method for the determination of finger flexor isometric finger strength that uses equipment readily available in climbing gyms. Determining the reliability and criterion validity of such a method would be advantageous in understanding the performance, determining optimal training prescription and monitoring climbers isometric finger strength. Therefore, the aim of the present study was to (1) determine the test-retest reliability of a maximal isometric finger strength testing protocol that uses a pulley system to add or remove weight to or from climbers body mass and (2) to establish the criterion validity of isometric finger strength with self-reported climbing performance for the disciplines of route climbing and bouldering.

METHODS

Experimental Approach to the Problem

To determine the test-retest reliability of the maximal isometric finger strength (MIFS) test 15 subjects visited the laboratory on two occasions within a seven-day period, each visit was separated by a minimum of 48 h at the same time of day (±2 h). During each of the visit's subjects completed their own warm-up, along with a standardised warm-up consisting of three climbs of approximately 10 hand movements using a set sequence of moves, along with two sets of a technical tasks which included twisting and square on climbing. Fatigue was limited by ensuring only moderate exercise difficulty and providing extended rest periods based on verbal feedback from the subject. Subjects were then familiarised with the hand position (**Figure 1**) and testing protocol and completed the MIFS test. Body mass and maximum added load were recorded on each occasion.

To establish criterion validity data were collected as part of a larger profiling assessment package, conducted prior to the commencement of a training intervention provided by the lead researcher and colleagues. All 229 subjects who met the inclusion criteria completed a pre-assessment questionnaire before arrival, allowing the researcher to check for qualification against the prerequisites. Before commencement, subjects were given a written and verbal explanation of the assessment protocols and the risks involved. Subjects were initially briefed on the purpose of the assessment, they then completed their own thorough warm-up, followed by a standardised warm-up, they were then familiarised with the hand position and testing protocol and completed the MIFS test. Body mass and maximum added load were recorded.

For both reliability and criterion validity subjects attended the laboratory in a rested state (having performed no heavy exercise in the 24 h preceding the test) and having refrained from consuming food and caffeinated beverages for three hours prior. They were also asked to ensure they had no damage to skin on their fingertips, as this can affect friction and therefore performance during testing.

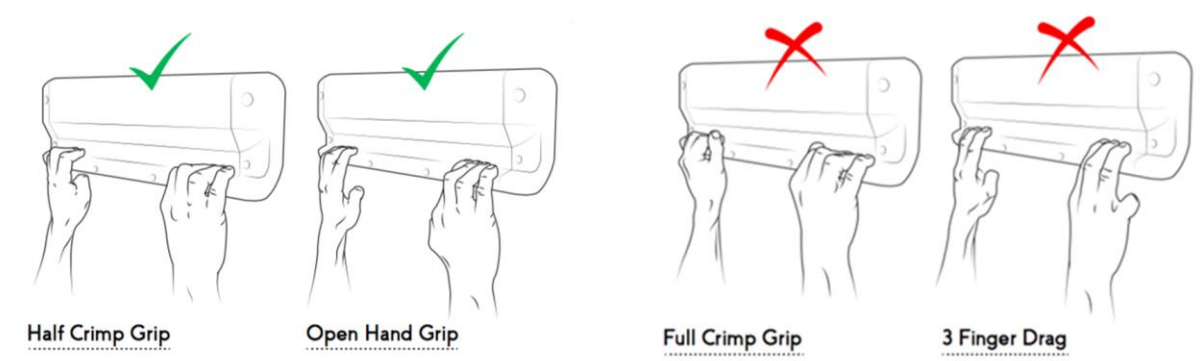

Figure 1: *Grip positions used (one arm, not two as shown) during the maximal isometric finger strength protocol. Half crimp grip and open hand grip were allowed without the use of the climber's thumb and chosen by personal preference. Full crimp grip and 3 finger drag were not permitted. Reproduced with permission of Lattice Training Ltd.*

Subjects

To ascertain the upper limit of reliability and criterion for the MIFS test a homogeneous cohort of healthy climbers were recruited. Subjects were recruited on the basis of being familiar with climbing specific forearm training, exhaustive forearm exercise, free from injury and having no known cardiovascular or respiratory diseases or illnesses. A total of 15 male subjects (mean ± SD: age 27.8 ± 7.0 yr, height 1.73 ± 0.05 m, body mass 65.5 ± 5.4 kg) were recruited for reliability analyses only. Using self-reported ability (9) the 15 subjects were categorised as Advanced to Elite level climbers (maximum 6-month red-point grade of sport: French 7b - 9a; UIAA IX- - XI+; 23.4 ± 2.7 International Rock Climbing Research Association [IRCRA] grading scale and boulder: Vermin V7 - V13; Font 7A - 8B; 24.6 ± 2.2 IRCRA).

In order to determine MIFS criterion validity with self-reported climbing ability, secondary analysis of Lattice Training Ltd. performance assessment database was conducted. The performance assessment database is made up of the data of climbers of a wide range of abilities who have completed a comprehensive physical climbing performance assessment by a Lattice Training coach. Lattice Training provided explicit written consent for the data to be used in publications. Anonymised data of only those clients who provided consent for their assessment data to be used for research purposes were then screened for eligibility for inclusion. The data inclusion criteria were as follows: (1) MIFS assessment conducted by a member of the research team (i.e. excluding assessments conducted by external coaches); (2) climbers with a minimum of five years climbing experience and self-reported ability between intermediate to higher elite (Route 15-29 & Boulder 15-29) using the IRCRA grades and categories (9); (3) who were familiar with climbing specific forearm training; and (4) were free from injury and had no known cardiovascular or respiratory diseases or illnesses. Based on these inclusion criteria, data of 229 intermediate to higher-elite sport rock climbers were included for criterion validity analysis only (Female n = 44: age 30 ± 10 yr, height 1.64 ± 0.06 m, body mass 55.0 ± 6.2 kg; Male n = 185: age 32 ± 10 yr, height 1.78 ± 0.11 m, body mass 70.9 ± 7.9 kg).

Written informed consent and medical health questionnaires were completed prior to participation. Institutional ethical approval was granted prior to data collection and all protocols conformed to the principles of the Declaration of Helsinki. Institutional ethical approval was granted for the secondary analysis of the data and conformed to the principles of the Declaration of Helsinki.

Methodology

Testing rung and hand positioning: During all visits, each finger hang was performed on a Lattice Training (Chesterfield, England) rung (20 mm deep, 10 mm radius; ***Figure 1***). All tests were performed in one of two self-selected grip positions, either a one-handed half-crimp hang position (90° flexion at the proximal interphalangeal joint [PIP] with the thumb not engaged in the grip), or a one-handed open-handed hang position (160° to 180° flexion at the proximal interphalangeal joint [PIP] with the thumb not engaged in the grip. In accordance with Baláš, et al. (3), subjects were instructed to hang with arms extended above the head (~170 to 180° shoulder flexion), maintaining a slight bend in the elbow with shoulders engaged (***Figure 2***). To modify the load, weight in half kg – five kg increments were either added or removed using a pulley system attached to either a climbing harness worn by the subject (additional load) or a pulley system with a handle (removing load). When adding additional load, one kg weight was kept on the pulley system to reduce any lateral rotation which can disrupt the subjects hanging position.

Figure 2: *Hanging position used incorporating a pulley system as an assisting load. Reproduced with permission of Lattice Training Ltd.*

Determination of maximal isometric finger strength (MIFS): MIFS was determined by performing a series of one-handed finger hangs on the lattice rung, with each attempt progressively increasing in load until failure. Only the dominant arm was tested for reliability, while both arms were tested when determining validity. Subjects were provided with 30 seconds rest between arms and 90 seconds rest between each attempt (120 single arm), thus a minimum of 120 seconds rest was provided between each attempt; 120 seconds was determined to be sufficient based on extensive testing of the protocol and has been used previously in the literature (2, 11). A successful hang was defined as the subject completing a five-second hang with their feet off the floor using the pulley system to control the load placed on the hanging arm. Failure was defined as being unable to complete the full five-second hang, movement of the fingers from the defined grip position during a loaded (included fingers becoming straighter [half crimp to open] or partially slipping of the hold [four fingers to three fingers]). Time of hang was recorded by the assessor using a standard stopwatch. The maximal score was taken from the highest load completed for a full five seconds whilst maintaining the same grip position throughout.

Briefly, each test proceeded as follows, each subject began testing using a sub-maximal load, selected by the assessor based on the athletes climbing grade and the assessors' experience. After the subject had completed the assessment at that load, mass was removed from the pulley to increase the load for the following set. Mass was removed or added in increments of one to five kg depending on the perception of effort verbally given by the athlete as interpreted by the assessor. Once close to a maximal score, weight was removed in 0.5 to 1kg increments to get as detailed a reading of the maximal load as possible. Ideally, the assessor would aim to reach a maximal score in eight sets or less to avoid cumulative fatigue (the average (mode) number of attempts across all assessments was five).

Self-reported climbing ability. Following the guidelines set out by the IRCRA (9) climbers reported their on-sight (without prior practice) grade for which they have completed three successful ascents on three different routes (at the grade) within the six months prior to data collection for both bouldering (short powerful climbs close to the ground) and sport climbing (longer more endurance-focused climbs, using ropes). The validity of self-reported climbing ability has previously been established by (8). The self-report method has been used for on-sight and red-point (red-point: climb completed after prior practice) performance extensively within the literature.

As many of the climbers reported grades for both sport and boulder, despite specialising in one discipline, self-reported climbing ability was screened prior to analysis. The criteria were: (1) for those who only reported one grade, which matched with their reported specialisation, this was taken as their grade and they were allocated to the relevant group; (2) if climbers reported spending more than 75% of their time in a particular discipline, they were allocated to the relevant group and only this grade included; (3) if the climber reported between 26 and 74% of their time spent in both disciplines they were included in both groups, unless the difference between the two grades exceeded ± three IRCRA grades. Following this, the bouldering sub-group consisted of 223 and the sport climbing subgroup 199 subjects, with 193 included in both data sets.

Statistical Analysis

All analysis was conducted using the SPSS statistical software package (IBM SPSS statistics, release 24, 2016, SPSS Inc., Chicago, IL, USA). Normal distributions were ascertained, and homogeneity of variances was confirmed after visual assessment of the frequency histogram and Shapiro–Wilk's test, respectively. All values are reported as mean ± SD. The agreement between the values of body mass (kg), mass added (kg), total load (body mass + mass added), and percentage of body mass (total load / body mass x 100) obtained from visit one and two were determined by calculating the intra-class correlation coefficient (ICC, model 3.1) (19). Bland–Altman plots were constructed and 95% limits of agreement (LoA) were calculated for between day reliability of finger strength (5). The ICC was interpreted as very good (0.81 – 1.00), good (0.61 – 0.80), moderate (0.41 – 0.60), fair (0.21 – 0.40), or poor (< 0.2) (1). The magnitude of the difference of the test-retest parameters was calculated by determining the effect size (ES) which represents the mean difference over the standard deviation of the difference (15); the difference was considered small when ES ≤ 0.2, moderate when ES ≤ 0.5, and great when ES > 0.8 (6). Left to right arm bias and 95% limits of agreement (LoA) were calculated to quantify intra-individual differences in finger strength arms (5). The relationship between MIFS and on-sight and red-point climbing performance was determined using Pearson's product moment correlations separately for both male and female athletes in both discipline groups.

RESULTS

Test re-test reliability data is presented in **Table 1**, with the bias and limits of agreement (LoA), ICCs, 95% confidence intervals and effect sizes, Bland Altman plots are shown in **Figure 3**. Bias between visits was greatest for body mass, and total load (body mass + load added), while load and percentage body mass varied by the smallest amount. In all cases ICCs were > 0.91 and interpreted as very good (all lower confidence intervals were > 0.81, with the exception of total load of 0.75 - good) and effect sizes were < 0.20 in all cases and interpreted as small.

Table 1: *Maximal isometric finger strength data for the dominant arm from visits one and two (mean ± SD), with bias and limits of agreement (LoA), intra-class correlation coefficients (ICC) and 95% confidence intervals.*

Measure	**Visit 1 (mean ± SD)**	**Visit 2 (mean ± SD)**	**Bias (LoA)**	**ICC (95% CI)**	**Effect size (interpretation)**
Body mass (kg)	65.5 ± 5.4	65.6 ± 4.8	.17 (-2.69 – 3.03)	.961 (.888 - .987)	.20 (small)
Mass added (kg)	-5.3 ± 6.7	-5.4 ± 6.6	-.08 (-2.78 – 2.61)	.980 (.942 - .993)	.00 (small)
Total mass (kg)	*60.2 ± 5.4*	*60.2 ± 5.0*	*.08 (-4.36 – 4.53)*	*.909 (.751 - .969)*	*.16 (small)*
% body mass	*92.4 ± 9.7*	*92.2 ± 9.5*	*0 (-.04 – .04)*	*.976 (.931 - .992)*	*.02 (small)*

Note: Derived variables shown in italics; total load (body mass + load added); percentage of body mass (total load / body mass x 100)

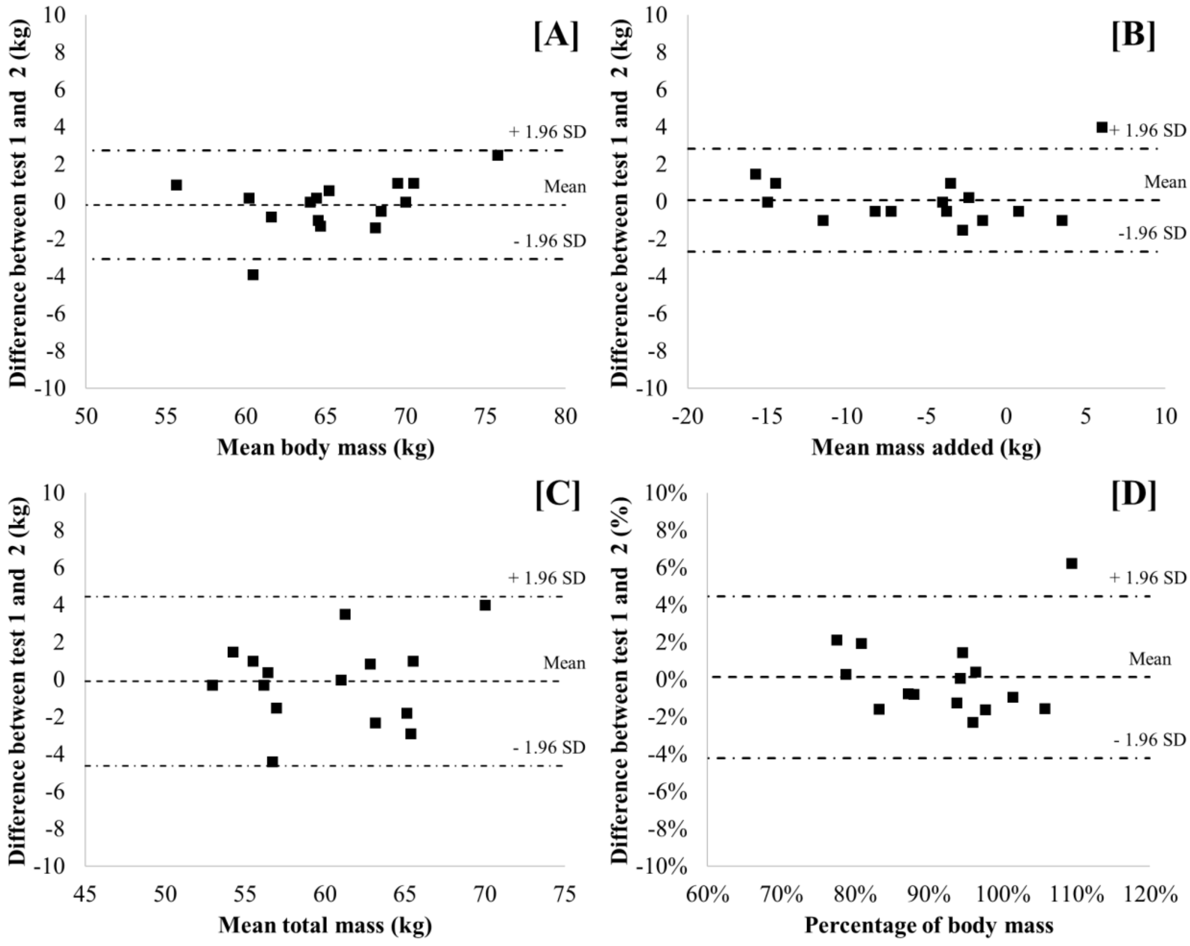

Figure 3: *Bland-Altman plots for body mass [A], mean mass added [B], total mass [C] and total mass expressed as a percentage of body mass [D] for the maximum isometric finger strength visits one and two.*

Criterion validity data for assessed body mass and load adjustment for left and right arms, between genders, are presented in **Table 2.** Computed variables of total mass and percentage body mass are also presented. Right to left arm bias was negative, indicating an average right arm bias of 0.61 to 0.66 kg (range 0 to 12 kg); however, handedness was not related to self-reported ability for either boulderers (RP r = 0.021, p = 0.756; OS r = 0.042, p = 0.541) or for sport climbers (RP r = -0.050, p = 0.494; OS r = -0.114, p = 0.117).

Table 2: *Maximal isometric finger strength data (mean ± SD) for the left and right arms of male and female, boulder and sport climbers with body mass, mass added and calculated total mass, percentage body mass and right to left arm bias (negative = right arm bias).*

	Body Mass (kg)	**Mass Added (kg)**	**Total Mass (kg)**	**% Body Mass**	**Right – Left bias (kg) [LoA]**
Boulder					
Male (n = 179)					
Left Arm	70.8 ± 7.3	-11.3 ± 7.4	59.8 ± 7.9	79.5 ± 9.9	-0.61 [-6.03 – 4.81]
Right Arm		-10.7 ± 7.2	60.2 ± 7.5	80.6 ± 9.5	
Female (n = 43)					
Left Arm	54.9 ± 6.2	-11.9 ± 5.1	43.5 ± 6.4	79.5 ± 9.9	-0.64 [-4.94 – 3.65]
Right Arm		-11.0 ± 5.0	44.3 ± 6.7	80.6 ± 9.5	
Sport					
Male (n = 160)					
Left Arm	70.9 ± 7.4	-11.4 ± 7.5	59.5 ± 7.8	84.3 ± 9.9	-0.62 [-6.12 – 4.88]
Right Arm		-10.9 ± 7.3	60.0 ± 7.5	85.1 ± 9.6	
Female (n = 39)					
Left Arm	54.7 ± 6.4	-11.8 ± 5.1	43.0 ± 6.3	78.6 ± 9.1	-0.66 [-5.03 – 3.71]
Right Arm		-11.2 ± 4.9	43.6 ± 6.6	79.8 ± 8.9	

Note: *LoA limits of agreement*

Regarding associations, the relationship between RP and OS self-reported ability for sport and boulder disciplines and dominant arm MIFS was consistently greatest when expressed as a percentage of body mass (**Table 3**). Only very small differences in the strength of the association were found when the same analysis was performed with results from the non-dominant arms (not shown; e.g. boulder male OS r = 0.474, RP r = 0.480).

Table 3: *Bivariate correlations between self-reported on-sight and red-point climbing performance and MIFS for the dominant arm by discipline and gender.*

	Body Mass (kg)	Maximum Load adjustment (kg)	Total Load (kg)	% body mass
Boulder				
Male				
On-sight grade	-0.116	0.483*	0.343*	0.506*
Red-point grade	-0.171	0.490*	0.297*	0.499*
Female				
On-sight grade	-0.079	0.511*	0.342*	0.553*
Red-point grade	-0.105	0.452*	0.262	0.469*
Sport				
Male				
On-sight grade	-0.254*	0.414*	0.145	0.421*
Red-point grade	-0.227*	0.427*	0.185*	0.434*
Female				
On-sight grade	0.000	0.406*	0.308	0.449*
Red-point grade	-0.077	0.470*	0.278	0.504*

Note: ** significant $p < 0.05$; OS without prior practice or knowledge; RP with prior practice*

DISCUSSION

The present study demonstrates the MIFS protocol's reliability and criterion validity with self-reported bouldering and sport climbing performance. MIFS is an easy reproduced, low-cost means of assessing maximal isometric finger strength in climbers. The climbers selected for inclusion in the study represent a wide range of abilities from intermediate to higher elite (9). The findings demonstrate (1) small bias, almost perfect ICC and small effect size between test-retest assessments of MIFS, separated by a minimum of 48 h – this was particularly true for aggregate variables which included variation in body mass; (2) assessed MIFS showed a positive association with on-sight and red-point sport and bouldering performance for both male and female climbers. Given the importance of the maximal strength of the finger flexors of climbers, the ease of the MIFS method, which only requires equipment that is readily available in most gyms and climbing walls, will be of utility for a wide number of climbers and coaches. Specifically, the results support the use of MIFS as a method for coaches and climbers to understand exercise tolerance, determine optimal training prescription and monitor adaptation of the finger flexors of climbers. This is especially important now that sport climbing is an Olympic sport that is rapidly growing in popularity.

The MIFS protocol, utilising a single testing edge (uniform climbing hold), free weights and a pulley system offers a low resource sport-specific means of determining the maximal isometric strength of the finger flexors of climbers. The data for the 15 advanced to elite level climbers demonstrates excellent reliability, with small bias, large ICC and small effect sizes for all measures (body mass and load added) and derived variables (total mass and percentage of body mass). Intra-trial reliability was comparable to that found by Baláš, et al. (2) using a single arm method (ICC of 0.88 – 0.97 and 0.88 – 0.94 for the left and right arms, respectively) when calculating body mass removed from a set of scales and by Michailov, et al. (14) using a finger flexor dynamometer (ICC of 0.88). Together, the findings indicate excellent test-retest reliability.

The protocol compliments, rather than replaces, more expensive and/or specialist equipment which has previously been validated such as using electronic scales with a data logger (2) and custom made finger flexor dynamometer, known as the 3DSAC (14). Like the methods of Baláš, et al. (2) and Michailov, et al. (14) it allows climbers finger strength to be assessed utilising finger, hand and arm positions that are representative of those found in the sport (2, 3, 14). However, it remains to be seen whether there is good agreement between methods that employ a digital measurement of peak finger strength and the present methodology, where performance at a given intensity is determined based on a pass or fail of a five-second contraction at a given intensity.

Isometric finger strength is positively associated with self-reported on-sight (without prior knowledge) and red-point (knowledge and practice of a climb) performance for both the climbing disciplines of sport and bouldering. Assessed load adjustment and total load when expressed as a percentage of body mass was positive associated with on-sight and red-point sport and bouldering performance, for both male and female climbers (r = 0.421 – 0.503). Relative, rather than absolute, values appear to be the most important performance metric, as the strength of the association was greater in all cases when expressed relative to body mass, in comparison to total load. (**Table 3**). The relationship between finger strength and climbing performance is comparable to that of Wall, et al. (16) (boulder performance r = 0.634 – 0.665 and sport climbing r = 0.428 – 0.497). However, they are lower than those of Baláš, et al. (2) (redpoint r = 0.625 and on-sight r = 0.648), particularly when controlling for the effects of body mass (red-point r = 0.788 and on-sight r = 0.808). Aside from differences in the hand positions used, it is possible that some of the difference between the results of the present study and that of Baláš, et al. (2) and Michailov, et al. (14) are due to the way in which finger strength was calculated. For instance, Baláš, et al. (2) took the peak value from a contraction lasting between three – five seconds, in comparison the present study which required climbers to complete the entire five second contraction before it was recorded as a successful repetition. It is possible to speculate that peak, rather than average contraction force may be more closely related to self-reported climbing performance, however, further research is necessary to determine if this is the case.

The MIFS protocol is a valuable tool for coaches and researchers that allows for the identification of maximal isometric finger strength. However, several limitations should be acknowledged. Firstly, the MIFS protocol, as described, assesses single arm isometric finger strength, which is unlikely to be appropriate for use with lower grade climbers, or climbers who are not familiar with single arm hangs. Secondly, hand positions were not controlled for, with subjects allowed to use a flexed 'half-crimp' position or an extended 'open-handed' position, this may account for some of the variability seen in the results, as previous authors including Baláš, et al. (2) reported greater force production in half-crimp rather than open handed positions. Future research should determine whether there are differences in isometric finger strength when using the MIFS protocol and when calculated from peak force using a digital force plate. Finally, body mass appears to be an important factor when determining maximum isometric finger strength, further research is necessary to determine optimal training practises for the development of isometric strength and its interaction with body mass in climbers.

To conclude, the results demonstrate the sensitivity of the protocol for the determination of maximal isometric strength in the finger flexors of climbers from an ecologically valid, climbing specific test that only requires equipment found at most climbing walls. The maximal isometric finger strength test protocol, using a system of removing or adding load relative to climbers' body mass, appears to be a reliable test with test-retest ICC values for strength when expressed as a percentage of body mass of 0.976 (95% CI 0.931 - 0.992). Furthermore, the observed relationships of MIFS as a percentage of body mass and self-reported climbing ability of $r = 0.421 – 0.553$ are comparable to those seen in previous research which have used sport specific dynamometers, demonstrating it to be a valid means of determining finger strength in sport climbers and boulderers. A number of digital and manual methods have now been described in the literature, further research is necessary to explore potential differences in the digital measurement of peak finger strength and the present methodology, where performance at a given intensity is determined based on a pass or fail of a contraction at a given intensity.

PRACTICAL APPLICATIONS

The protocol described in the present study is a reliable and valid means of determining the maximal isometric finger strength of sport climbers and boulderers. It provides coaches and athletes an easy to administer, low coast method using equipment that is readily found in many climbing gyms. Such a method has wide reaching utility, for instance assessing isometric finger strength before and after a training intervention to determine their efficacy or when prescribing load intensities for exercises aimed at improving maximal finger strength. The results also demonstrate the importance of expressing climber's finger strength in relation to body mass, either as a ratio or a percentage.

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