Normative Data for the 5 Position Baseline Hydraulic Pinch Meter® and the Relationship between Lateral Pinch Strength and Pinch Span

Nancy Hock, OTRL, CHT and Debra Lindstrom, PhD, OTRL
Western Michigan University

Introduction

- Newly developed Baseline® 5 Position Hydraulic Pinch Meter allows pinch strength assessment at five different pinch spans.
- Develop normative data using healthy subjects,
- Evaluate 5 Position Pinch meter interrater reliability,
- Identify which pinch span the greatest force was produced.

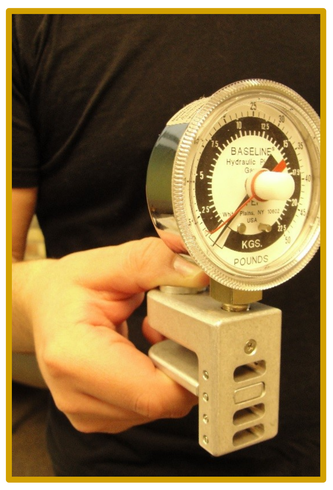


Figure 1. Photo of Baseline pinch meter with subject performing lateral pinch.

Methods

Reliability

- 18 teams of 2 were created, pairing each of the students into unique teams.
- ICC was calculated.

Data Analysis

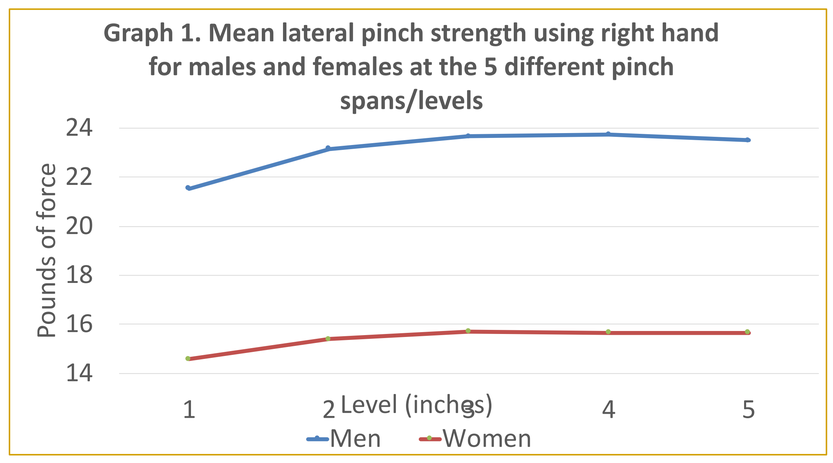
- Data stratified by age and sex for normative standards and analyzed
- One-way repeated measures ANOVA (means of 5 different pinch span levels)
- Three-way mixed ANOVA (Interaction between pinch span levels, age and sex).

Normative Data

- Healthy adult subjects for normative data were recruited from various locations in West Michigan.
- Power analysis was performed using G Power, indicating a recommended sample of 532 to detect a moderate effect size (0.30) at 95% power with an alpha of 0.05.
- Exclusion criteria: neurologic history or orthopedic injury to the upper quadrant within the last year.

Results

- Excellent interclass correlation (ICC) = 0.981.
- Sample size = 605 (292 males & 313 females)



Pinch span/level where the greatest force	
• Males R hand = 4th level (5cm pinch span) • Males L hand = 3rd level (4 cm pinch span)	• Females R Hand = 3rd level (4cm pinch span) • Females L Hand = 3rd level (4cm pinch span)
• A statistically significant 2 way interaction was identified between pinch spans/levels and sex.	• The magnitude of pinch force produced at the 5 different pinch spans differs slightly based on sex.
Post hoc testing (Bonferroni adjustment) • Significant differences with R hand (males & females) between the 1st level on the pinch meter compared to the 2nd, 3rd, 4th and 5th levels & the 2nd level when compared to the 3rd and 4th levels. • Significant differences with L hand (males and females) between the 1st level of the pinch meter when compared to the 2nd, 3rd, 4th and 5th levels. • All other comparisons were not statistically significant	

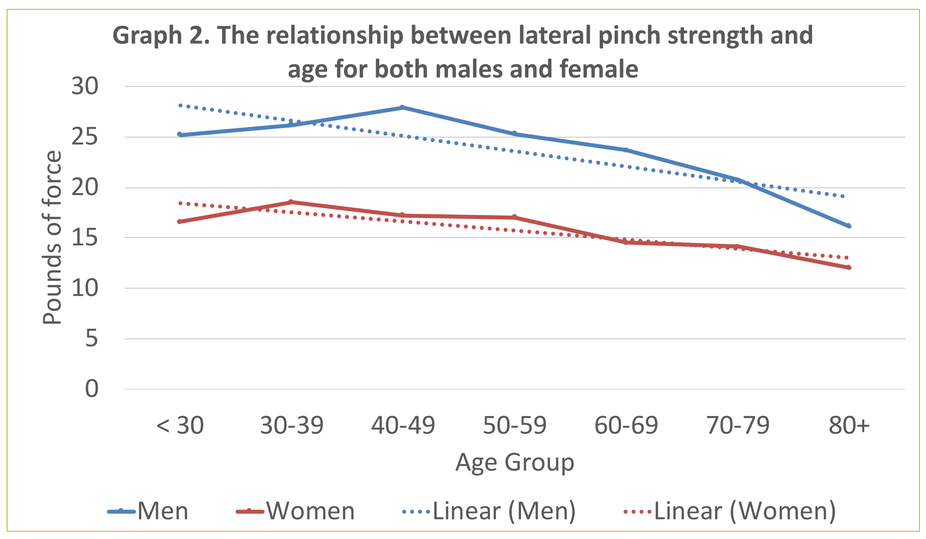


Figure 2. > 1cm of pinch span

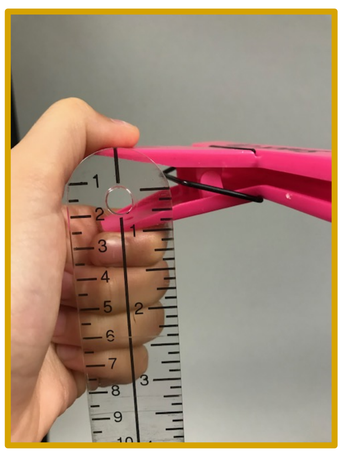


Figure 3. 2 cm of pinch span

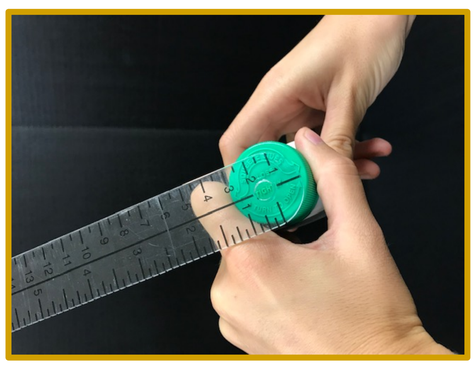


Figure 4. 3cm of pinch span

Population	df	F	Sig.	Partial Eta Squared
One-way mixed ANOVA				
Males R Hand	2.49, 725.21	87.68	p<.001	.23
Females R Hand	2.15, 670.21	47.49	p<.001	.13
Males L Hand	2.38, 692.99	37.08	p<.001	.11
Females L Hand	2.04, 636.56	20.74	p<.001	.06
Two-way mixed ANOVA (pinch spans/levels and sex)				
R Hand	2.37, 1400.65	12.76	p<.001	.021
L Hand	2.26, 1332.74	6.32	p<.001	.011
Three-way mixed ANOVA (pinch spans/levels and sex and age)				
R Hand	14.22,1400.65	.91	p=.552	.009
L Hand	13.53, 1332.74	.55	P=.899	.006

Discussion

- Greatest pinch force to be generated at 4-5 cm of pinch span which was similar to the findings of Dempsy & Ayoub who found the greatest pinch strength to be produced at 5cm of pinch span.
- Findings conflict with much of the previous literature - studies may have utilized unreliable measurement tools.
- Pinch force strength declines during 30's in females and 40's in males – may result in difficulty performing functional tasks such as opening food packages.
- Results could be beneficial to clinicians when modifying tasks or building up handles or utensils to various pinch spans.

Limitations:

- Normality was violated using the Shapiro-Wilks test. ANOVA is considered robust to deviations from normality.
- Two data points were noted to be extreme outliers out of 18,150 data points.
- Sphericity was violated through examination using Maunchly's test of sphericity, indicating a heterogeneous sample. As a result, the Greenhouse-Geisser correction was used when interpreting results.

Strengths:

- Large sample size.
- The Baseline 5 Position Hydraulic Pinch Meter was found to demonstrate excellent IRR.

WESTERN MICHIGAN UNIVERSITY

Fabrication Enterprises provided three pinch meters to use for data collection. These were returned following study completion.
The authors have no financial relationship with Fabrication Enterprises, the manufacturer of the 5 Position Baseline® Hydraulic Pinch Meter.