THE SWEDISH SCHOOL OF SPORT AND HEALTH SCIENCES

Development and reliability of a sport specific isometric strength test battery for para-kayak

Anna Bjerkefors[1,2], Matilda Ekman[1], Johanna S. Rosén[1]
[1]The Swedish School of Sport and Health Sciences (GIH), Biomechanics and Motor Control Laboratory
[2]Department of Neuroscience, Karolinska Institute
Stockholm, Sweden

international canoe federation

Paracanoe – debuted at the Paralympics in Rio 2016

Para-kayak

Para-va’a

Identify key biomechanical factors for performance

<u>Whole body 3D kinematics</u>

Joint angles for arm, trunk and legs: max, min, ROM

<u>Kinematics and kinetics</u>

Power output

N = 44 para-kayak athletes
N = 10 able-bodied sprint kayak athletes

Correlations between power output and joint movements

		Males		Females	
		r-value	*p*-value	r-value	*p*-value
Trunk	Trunk flexion$_{Max}$	0.802	<0.001	0.632	0.007
	Trunk and pelvis rotation ROM	0.724	<0.001	0.847	<0.001
Lower limbs	Hip flexion ROM	0.739	<0.001	0.898	<0.001
	Knee flexion ROM	0.740	<0.001	0.866	<0.001
	Ankle flexion ROM	0.670	<0.001	0.774	<0.001

Develop measures of impairment

Trunk (42 tests)

Manual muscle tests

Seated balance tests

Leg (14 tests)

Sport specific leg tests

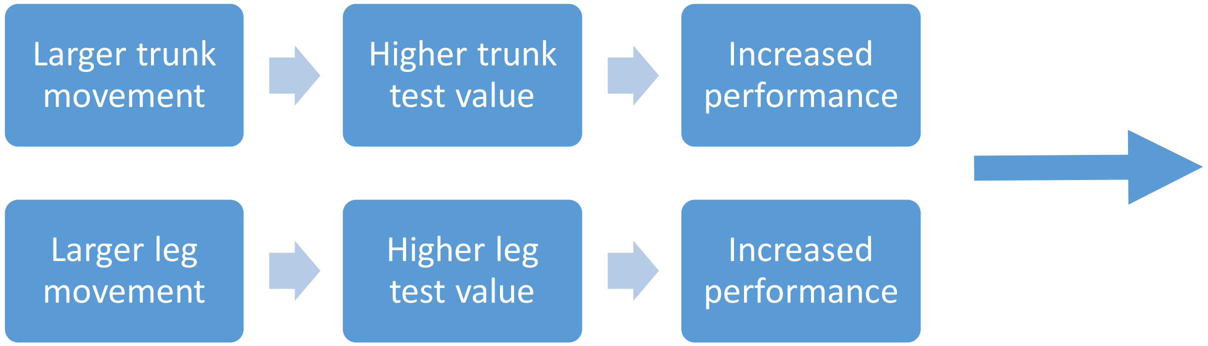
On-water (6 tests)

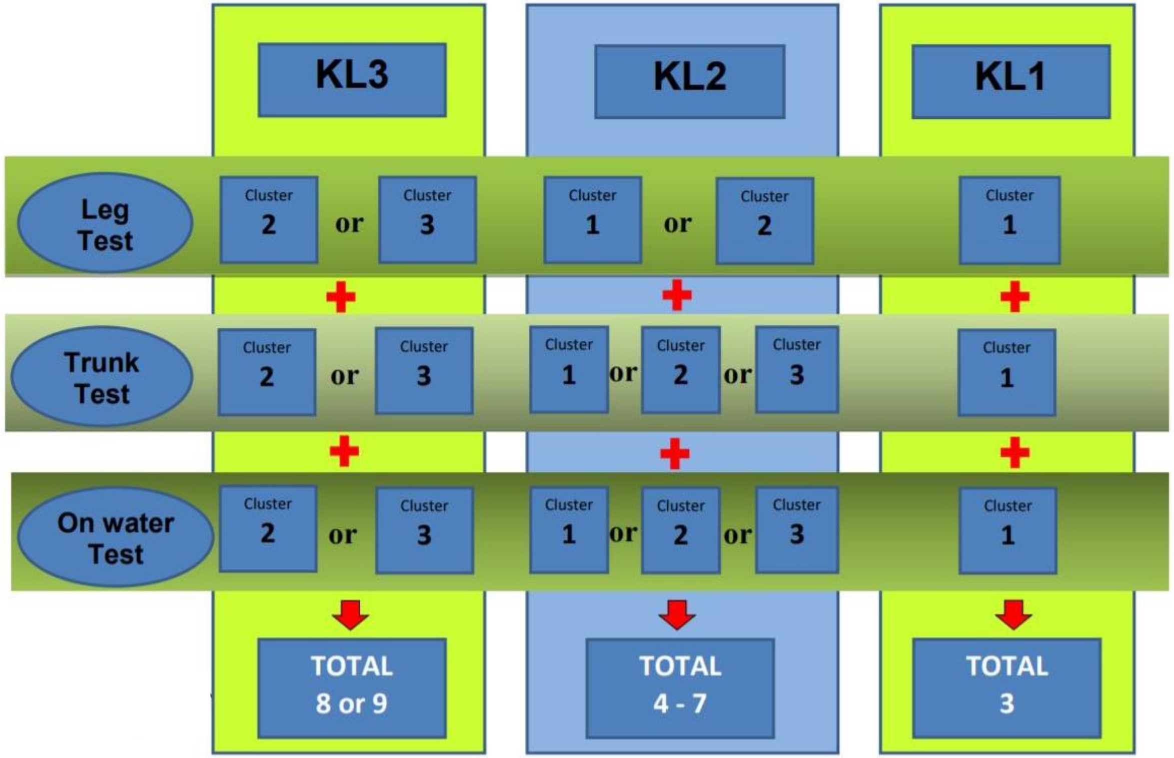
Trunk and leg function tests

← **Medical assessment** →

Technical assessment

Relationship between key factors for performance, measures of impairment and performance





Paralympic para-kayak classification

Purpose

- to design and develop a test battery for measuring isometric strength in kayak specific positions
- to examine the reliability of this battery in able-bodied people

Method

- Twelve able-bodied participants (ten females)
- Four isometric strength tests
    - leg press, knee extension, hip extension and trunk flexion

- Three maximal isometric contractions (5 s)
- 30 s rest between each trial
- 24 hours and a maximum of 7 days between the two occasions

Equipment

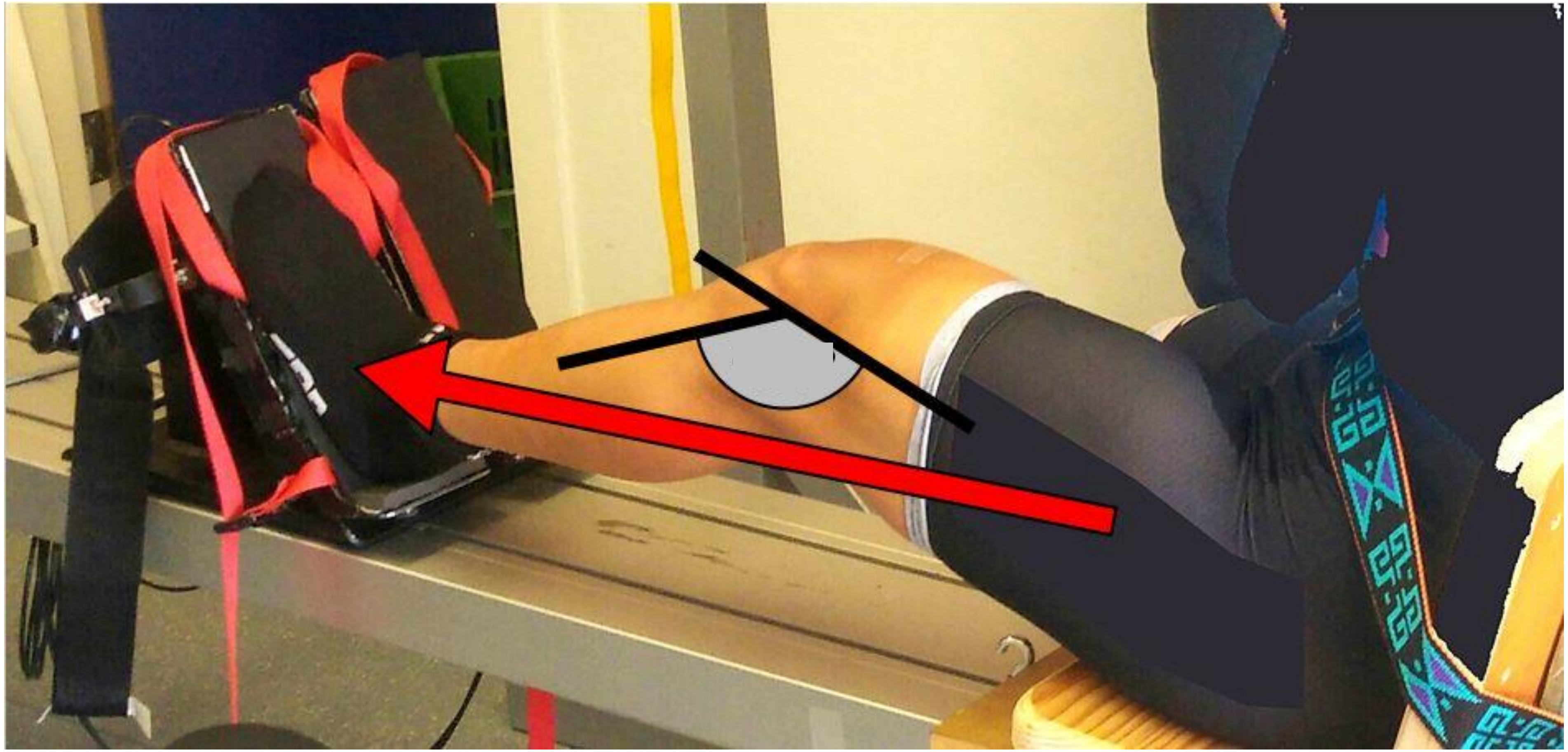
- 1D piezoelectric force transducer (9311B, Kistler; Switzerland)

– hip and knee extension, trunk flexion

- 3D piezoelectric force transducer (9347B, Kistler; Switzerland)

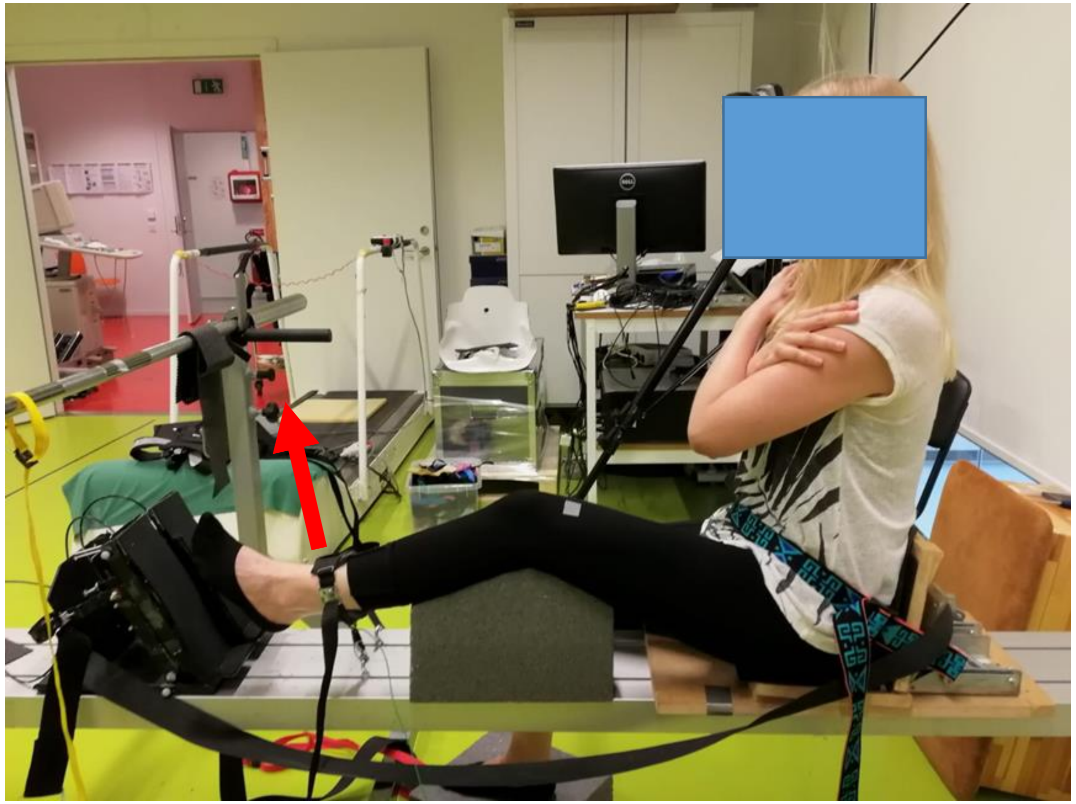
– leg press

Leg press



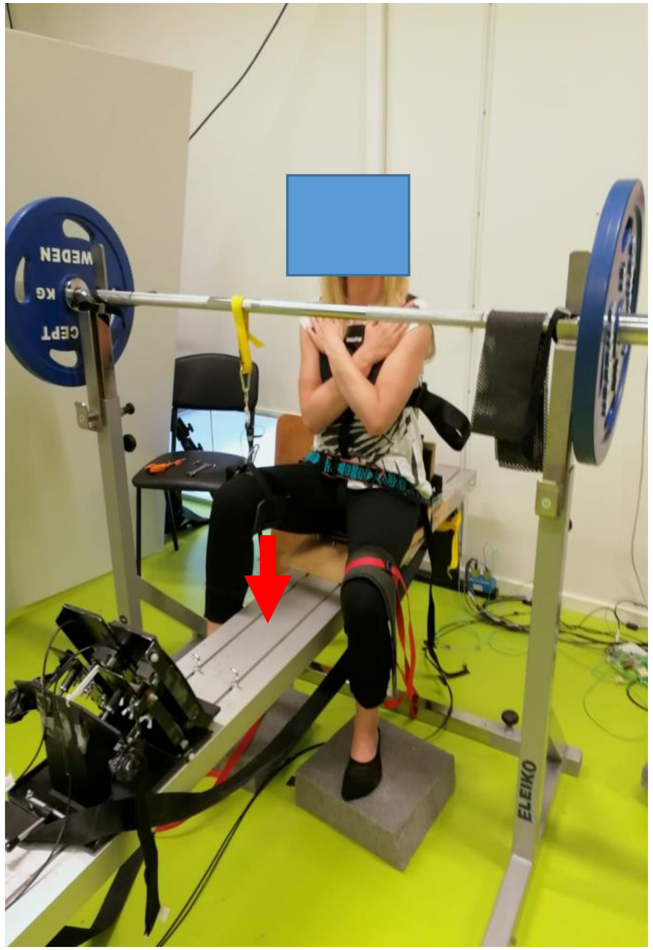
50° knee flexion

Knee extension



50° knee flexion

Hip extension



110° hip flexion

Trunk flexion

5° trunk flexion

Statistics for test-retest reliability

The mean of three trials was used

2-way random effects, absolute agreement, single rater/measurement intra-class correlation coefficient ($ICC_{2,1}$)

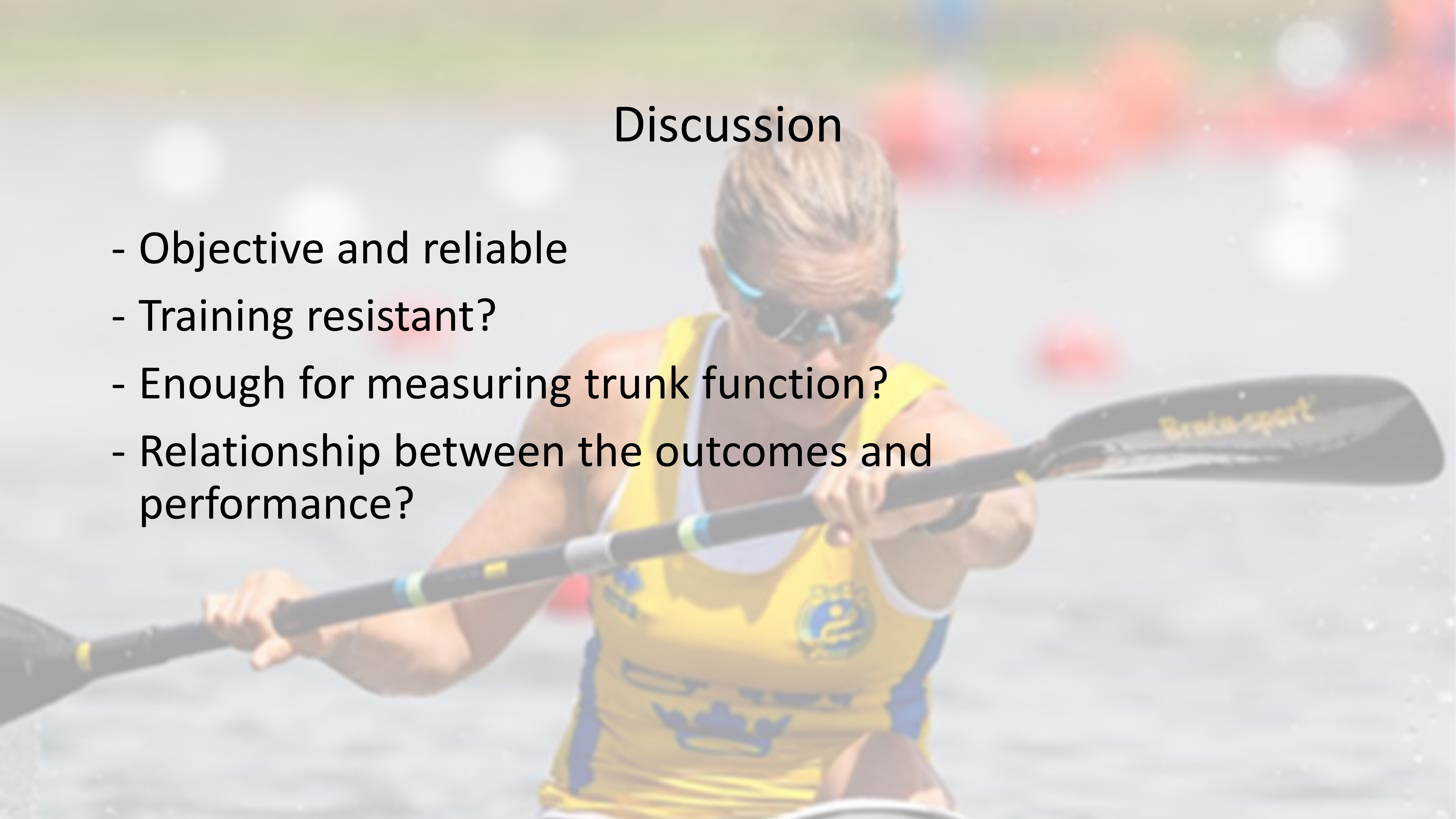
Student t-test - difference between test-retest values

Results

		Test occasion 1		Test occasion 2		ICC	95% CI
		±	SD	±	SD		
Leg press	Right	1330,9	310,0	1354,2	292,4	0,92	0,69-0,98
	Left	1354,0	294,5	1352,2	286,5	0,90	0,63-0,97
Hip extension	Right	292,0	93,0	290,7	101,2	0,96	0,88-0,99
	Left	277,7	91,7	272,0	80,7	0,96	0,85-0,99
Knee extension	Right	425,0	85,3	290,7	101,2	0,94	0,78-0,98
	Left	390,5	72,2	416,1	120,6	0,79	0,25-0,94
Trunk flexion		389,2	129,4	364,7	107,0	0,93	0,71-0,98

Results

		T1-T2 (N)	P-value
Leg press	Right	-23,3	0,67
	Left	1,7	0,98
Hip extension	Right	1,4	0,90
	Left	5,6	0,61
Knee extension	Right	-19,6	0,18
	Left	-25,6	0,33
Trunk flexion		24,5	0,24



Discussion

- Objective and reliable
- Training resistant?
- Enough for measuring trunk function?
- Relationship between the outcomes and performance?

Conclusion

Reliable method for evaluating kayak specific isometric strength in an able-bodied population

GIH THE SWEDISH SCHOOL OF SPORT AND HEALTH SCIENCES

Thank you for your attention!

international canoe federation