Effect of Gender on Range-of-Motion, Hamstring Flexibility, and Perceived Lumbosacral Pain in NCAA Division II Collegiate Rowers

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ABSTRACT

Rowers incur very high rates of chronic lumbosacral pain among athletic groups. This is likely due to repeated high intensity performance bouts, characterized by repetitive flexion & rotational loading. To our knowledge, no study has examined gender effects on upper & lower body range-of-motion (ROM), hamstring flexibility, & perceived pain in NCAA Division II collegiate rowers.

Purpose: To: (1) determine differences in upper & lower body ROM, hamstring flexibility, & various pain-related scales in male & female rowers, &; (2) examine potential outcome interactions by gender & rowing position (re: port vs. starboard).

Methods: A convenience sample of 17 male (mean age =20.2±1.3 years, mean height=184.5±7.4cm, mean bwt=78.0±9.3kg, mean BMI=22.9±2.1) & 9 female (mean age =20.4±1.3 years, mean ht=170.7±4.6cm, mean bwt=70.0±9.8kg, mean BMI=24.0±3.1) rowers were recruited for the study. Subjects gave IRB-approved informed consent prior to participation. Subjects completed a modified, Likert-like battery assessing multiple pain aspects/scenarios (re: low back, weight training, change-of-direction, sitting, sleep disruption, recurrence fear, sport-specific) prior to testing. After familiarization & ~5-10-minute general warm-up, subjects were evaluated as follows: bilateral upper (shoulder flexion/extension, trunk rotation) & lower (hip flexion/extension, hip abduction/adduction) body ROM (Jamar E-Z Read® goniometer); spinal flexion/extension (Mabis tape measure), &; hamstring flexibility (Acuflex I sit-&-reach box). Means & SDs were calculated for all variables. A 1-way ANOVA was used to determine if differences existed between genders; where differences were identified, an independent t-test determined which gender group differed. Multivariate analysis was used to determine potential interaction by gender & rowing position. Significance level was set at p ≤ 0.05.

Results: Males were significantly taller (184.5±7.4 vs. 170.7±4.6kg, p=0.002) & heavier (78.0±9.3 vs. 70.0±9.8kg, p=0.001) vs. females, however BMI did not differ between genders. Females exhibited greater ROM vs. males in right (96.4±14.5 vs. 83.5±14.8º, p=0.04) & left (98.0±16.5 vs. 79.0±16.0º, p=0.009) hip flexion, & left hip extension (20.0±8.6 vs. 14.8±4.4º, p=0.04). Females reported greater sleep-disrupting pain vs. males (p=0.003). A significant gender x rowing position interaction was found for spinal flexion (p=0.008), spinal extension (p=0.01), right (p=0.007) & left (p=0.04) hip flexion, & right (p=0.007) & left (p=0.04) hip abduction.

Conclusions: Males & females differed demographically only in ht & wt, although BMI did not differ between genders. No difference was found between genders for any upper body ROM measure, though females demonstrated significantly greater ROMs in spinal flexibility & several lower body flexibility measures. No gender differences were found for any pain scale, except females reported greater pain-induced sleep disruption vs. males. The significant interactions (gender x rowing position) observed may indicate a potential spinal & hip ROM advantage for female rowers seated port side.

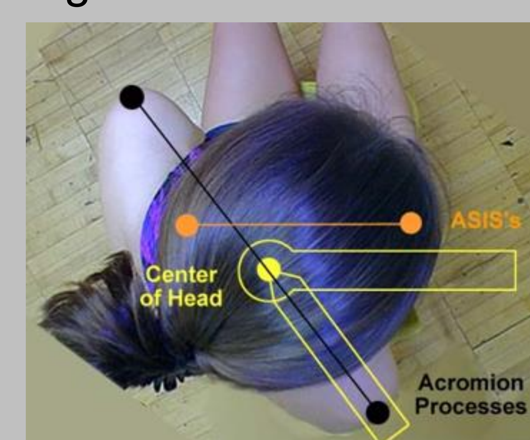
Practical Application: S&C practitioners should consider specific demographic characteristics, along with rowing kinematics, when devising a sport-specific exercise prescription for rowers. Additionally, S&C professionals should also consider rowing position (port vs. starboard side) when implementing a sport-specific strength & conditioning program for rowing athletes.

INTRODUCTION

Successful rowing performance requires sufficient mobility, stability, and muscular endurance of the thorax, lumbar spine, hips, and legs. Rowers incur very high rates of chronic lumbosacral pain among athletic groups[1]. This is likely due to repeated high intensity performance bouts, characterized by repetitive flexion & rotational loading[2]. Transmission of high leg forces during trunk flexion over many rowing cycles is a risk factor for low back disorders, intervertebral disc problems and ligamentous structures disorders[3]. To our knowledge, no study has examined gender effects on upper & lower body range-of-motion (ROM), hamstring flexibility, and perceived pain in NCAA Division II collegiate rowers.

METHODS

A convenience sample of 17 male (mean age =20.2±1.3 years, mean height=184.5±7.4cm, mean bwt=78.0±9.3kg, mean BMI=22.9±2.1) & 9 female (mean age =20.4±1.3 years, mean ht=170.7±4.6cm, mean bwt=70.0±9.8kg, mean BMI=24.0±3.1) rowers were recruited for the study. Subjects gave IRB-approved informed consent prior to participation. Subjects completed a modified, Likert-like battery assessing multiple pain aspects/scenarios (re: low back, weight training, change-of-direction, sitting, sleep disruption, recurrence fear, sport-specific) prior to testing. After familiarization & ~5-10-minute general warm-up, subjects were evaluated as follows: bilateral upper (shoulder flexion/extension, trunk rotation) & lower (hip flexion/extension, hip abduction/adduction) body ROM (Jamar E-Z Read® goniometer); spinal flexion/extension (Mabis tape measure), &; hamstring flexibility (Acuflex I sit-&-reach box). Means & SDs were calculated for all variables. A 1-way ANOVA was used to determine if differences existed between genders; where differences were identified, an independent t-test determined which gender group differed. Multivariate analysis was used to determine potential interaction by gender & rowing position. The Pearson-Product moment correlation was used to examine relationships between subject demographics, pain scale inventory responses, and flexibility/ROM performance. Significance level was set at p ≤ 0.05.



RESULTS

Table 1: Demographic Comparison – By Gender (Mean ± SD)

Dependent Variable	Males (n = 17)	Females (n = 9)
Age (yrs)	20.2 ± 1.3	20.4 ± 1.3
Height (cm)	184.5 ± 7.4[a]	170.7 ± 4.6
Weight (kg)	78.0 ± 9.3[b]	70.0 ± 9.8
BMI	22.9 ± 2.1	24.0 ± 3.1

Table 2: Gender Comparison – Flexibility Measures (Mean ± SD)

Measurement Variable	Males (n = 17)	Females (n = 9)
Sit-and-Reach (cm)	6.7 ± 0.4	6.2 ± 0.8
Spinal Flexion (cm)	1,065.04 ± 101.6	866 ± 162.7
Spinal Extension (cm)	22,256.4 ± 2,055.8	19,641.3 ± 3,432.3

Table 5: Group Comparison – Goniometry Measures (Mean ± SD)

Measurement Variable (degrees)	Males (n = 17)		Females (n = 9)	
	Right	Left	Right	Left
Trunk Rotation	75.8 ± 12.0	69.8 ± 11.8	81.2 ± 9.5	71.5 ± 12.4
Shoulder Flexion	169.0 ± 16.7	168.0 ± 15.8	158.0 ± 22.0	161.6 ± 24.5
Shoulder Extension	70.2 ± 10.9	66.8 ± 12.3	66.7 ± 11.4	69.4 ± 10.7
Hip Flexion	83.5 ± 14.8	79.1 ± 16.0	96.4 ± 14.5[c]	98.0 ± 16.5[d]
Hip Extension	15.2 ± 5.1	14.8 ± 4.4	19.3 ± 7.0	20.0 ± 8.6[e]
Hip Abduction	32.5 ± 8.3	32.7 ± 7.8	31.9 ± 9.8	34.9 ± 6.5
Hip Adduction	23.1 ± 4.4	22.7 ± 5.0	26.1 ± 4.6	24.1 ± 4.0

[a] mean difference significantly greater vs. females (p = 0.002)
[a] mean difference significantly greater vs. females (p = 0.001)
[c] mean difference significantly greater vs. males (p = 0.04)
[d] mean difference significantly greater vs. males (p = 0.009)
[e] mean difference significantly greater vs. males (p = 0.04)

RESULTS (cont.)

- Males were significantly taller and heavier than females, however no difference in BMI was found between genders.
- No difference was found between genders for any upper body ROM measure.
- Females demonstrated significantly greater ROMs in bilateral hip flexion and left-sided hip extension vs. males.
- No gender differences were found for any pain scale, except females reported greater pain-induced sleep disruption vs. males (p = 0.003).
- A significant gender x rowing position (re: starboard vs. port) interaction was found for spinal flexion (p = 0.008), spinal extension (p = 0.01), right (p = 0.007) and left (p = 0.04) hip flexion, and right (p = 0.007) and left (p = 0.04) hip abduction.
- Low back pain scores were strongly correlated to reported weight training pain scores (r = 0.85, p < 0.001), rowing specific training pain scores (r = 0.68, p < 0.001), sitting pain scores (r = 0.54, p = 0.005), fear of back pain/injury scores (r = 0.61, p = 0.001).

CONCLUSIONS

Males and females differed demographically only in height and weight, although BMI did not differ between genders. No difference was found between genders for any upper body ROM measure, though females demonstrated significantly greater ROMs in spinal flexibility and several lower body flexibility measures. No gender differences were found for any pain scale, except females reported greater pain-induced sleep disruption vs. males. The significant interactions (gender x rowing position) observed may indicate a potential spinal and hip ROM advantage for female rowers seated port side. Future research should examine a larger subject pool from different NCAA geographic regions and potential musculoskeletal imbalance issues based upon rowing side (re: port vs. starboard). Other mitigating circumstances that may contribute to excessive spinal loading should also be investigated, including excessive “off-water” training with a rowing ergometer. Prior studies have determined that kinematic patterns differ between ergometer and “on-water” rowing technique, and prolonged bouts (re: >30 minutes) using the rowing ergometer are a significant predictor of lumbopelvic injury[4].

PRACTICAL APPLICATION

Strength and conditioning practitioners should consider specific demographic characteristics, along with rowing kinematics, when devising a sport-specific exercise prescription for rowers. Additionally, S&C professionals should also consider rowing position (port vs. starboard side) when implementing a sport-specific strength & conditioning program for rowing athletes. Furthermore, the evidence indicates that precise rowing technique may ameliorate increased spinal loading, and, therefore, anatomic-specific training may also reduce lumbopelvic injury risk in competitive rowers[4].

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