Comparison of Flywheel Eccentric Bent-over Row Exercise Variations: Electromyographic Responses of Shoulder and Back Musculature

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BACKGROUND

The flywheel maximizes eccentric muscle actions utilizing kinetic energy from concentric contractions.

With eccentric overload, this could mean greater spine stability and muscular endurance is required to maintain stiffness of the back. As a result, bent-over row exercises could create greater eccentric than concentric demands by the flywheel.

PURPOSE OF STUDY

1. Determine whether to challenge the back musculature or avoid high back loading.
2. Results could also be used for training considerations regarding shoulder positions.
3. Investigate differences in isotonic contractions and eccentric demand.

METHODOLOGY

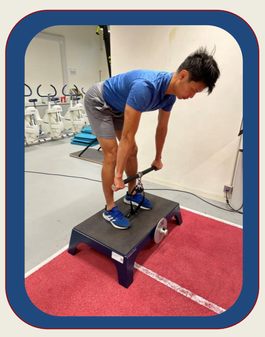
A Repeated Measures Study Design

- 8 male SRM students recruited and identified (non-random sampling)

Assessed the electromyographic (EMG) responses of:

Upper Trapezius (UT) | **Middle Trapezius (MT)** | **Posterior Deltoid (PD)** | **Latissimus Dorsi (LD)** | **Lumbar Erector Spinae (LES)**

Performed four different flywheel variations of the bent-over row exercise (BOR):


Standing-BOR with 90 degrees shoulder abduction

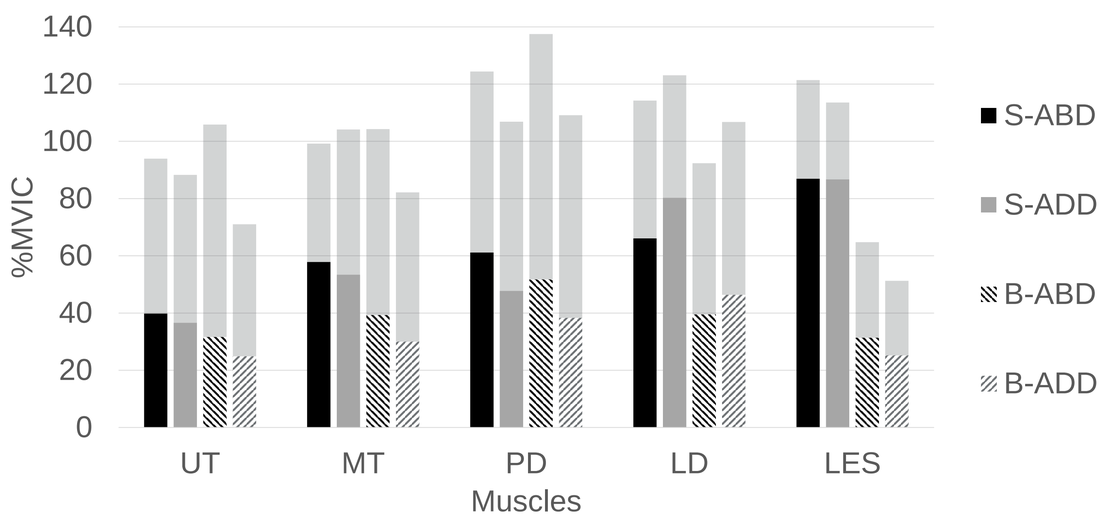

Standing-BOR with maximum shoulder adduction


Bench-BOR with 90 degrees shoulder abduction


Bench-BOR with maximum shoulder adduction

RESULTS

Average EMG (%MVIC) Eccentric and Concentric Muscle Activity Each Variations



Note. Greyed transparent bars represent concentric muscle activity.
UT = Upper trapezius; MT = Middle trapezius; PD = Posterior deltoid; LD = Latissimus dorsi; LES = Lumbar erector spinae; MVIC = Maximum voluntary isometric contraction.
S-ABD = Standing-BOR with 90 degrees shoulder abduction; S-ADD = Standing-BOR with maximum shoulder adduction; B-ABD = Bench-BOR with 90 degrees shoulder abduction; B-ADD = Bench-BOR with maximum shoulder adduction.

Friedman Test Bonferroni Post Hoc Results

Musculatures	S-ABD vs S-ADD	S-ABD vs B-ABD	S-ADD vs B-ADD	B-ABD vs B-ADD
Upper Trapezius	1.00[b]	1.00	0.07	0.07[b]
Middle Trapezius	1.00[b]	1.00	0.01	0.07[b]
Posterior Deltoid	0.49[b]	1.00	0.49	0.01[a]
Latissimus Dorsi	0.73[b]	0.07	0.02	1.00[b]
Lumbar Erector Spinae	1.00	0.04[a]	0.00[a]	1.00

Note. Statistical differences were shown among all variations in Friedman Test ($p < 0.05$). Thus. Post hoc test was performed.

Wilcoxon Signed-Rank Test Results

Musculatures	S-ABD vs S-ADD	S-ABD vs B-ABD	S-ADD vs B-ADD	B-ABD vs B-ADD
Upper Trapezius	0.33[b]	0.12	0.01	0.05[a]
Middle Trapezius	0.09[b]	0.16	0.01	0.01[a]
Posterior Deltoid	0.02[a]	0.26	0.02	0.01[a]
Latissimus Dorsi	0.02[a]	0.02	0.01	0.03[a]
Lumbar Erector Spinae	0.67	0.01[a]	0.01[a]	0.01

[a]Represents relevant significant differences ($p < 0.05$)
[b]Represents relevant non-significant differences ($p > 0.05$)

DISCUSSION

Eccentric Findings in Back Musculature

Bench variations -> Avoid high eccentric back loading

Standing variations -> Higher spinal load

Eccentric Findings in Shoulder Musculature

Similar activation in both shoulder positions

More Latissimus dorsi activation in adducted position

Findings Between Contractions

Reduced Eccentric Contraction -> Protect muscles

Eccentric demand? -> Need force sensors to measure

PRACTICAL APPLICATION

Bench variations: Avoids high eccentric back loading + focus on the activation of multiple upper back musculatures regardless of shoulder positions.

Focus on the back and shoulder musculature: Perform standing + any shoulder positions.

Focus the latissimus dorsi in a standing or bench position: Perform in maximum shoulder adduction.

Potential investigation: Measure eccentric overload and power output -> Understand and manage exercise prescriptions + monitor measurable eccentric overload.