

Title: Influence of Resistance Training Proximity-to-Failure, Determined by Repetitions-in-Reserve, on Neuromuscular Fatigue in Resistance-Trained Males and Females.

Running title: Influence of Proximity-to-Failure on Neuromuscular Fatigue.

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S1. Total Volume

1.1 Linear Mixed Effects Model (Protocol x Sex)

Effect	DF	F-Value	P-Value
Protocol	2	12.32	<0.001
Sex	1	17.80	<0.001
Protocol x Sex	2	1.59	0.204

1.1.1 Tukey's Pairwise Comparisons

Protocol	ES (CI)	P-Value
1-RIR vs. 3-RIR	0.40 (0.21, 0.60)	<0.001
1-RIR vs. FAIL	-0.18 (-0.30, -0.06)	0.015
3-RIR vs. FAIL	0.18 (-0.03, 0.39)	0.117
Sex		
Male vs. Female	1.58 (1.05, 2.11)	<0.001

1.1.2 Descriptive Statistics [Total Volume (Sets x Repetitions)]

Protocol	Mean	SD
1-RIR	52	12
3-RIR	57	13
FAIL	54	15
Sex		
Males	46	7
Females	63	13
Protocol x Sex		
1-RIR (Male)	49	8
1-RIR (Female)	65	12
3-RIR (Male)	44	7
3-RIR (Female)	59	12
FAIL (Male)	45	8
FAIL (Female)	64	14

S2. Recovery Time-Course from Pre-Exercise to Post-Exercise

2.1 Linear Mixed Effects Model (Protocol x Time)

Effect	DF	F-Value	P-Value
Protocol	2	52.81	<0.001
Time	2	229.58	<0.001
Protocol x Time	4	18.18	<0.001

2.1.1 Tukey's Pairwise Comparisons

Protocol	ES (CI)	P-Value
1-RIR vs. 3-RIR	0.66 (0.46, 0.85)	<0.001
1-RIR vs. FAIL	0.26 (0.10, 0.42)	<0.001
3-RIR vs. FAIL	0.58 (0.41, 0.74)	<0.001
Time		
24-hrs vs. 48-hrs	0.32 (0.11, 0.54)	0.067
24-hrs vs. 4-min	1.55 (1.24, 1.87)	<0.001
48-hrs vs. 4-min	1.83 (1.42, 2.25)	<0.001
Protocol x Time		
1-RIR vs. 3-RIR (4-min)	1.26 (0.80, 1.73)	<0.001
1-RIR vs. FAIL (4-min)	1.16 (0.68, 1.63)	<0.001
3-RIR vs. FAIL (4-min)	1.87 (1.26, 2.47)	<0.001
1-RIR vs. 3-RIR (24-hrs)	1.02 (0.40, 1.64)	0.001
1-RIR vs. FAIL (24-hrs)	0.01 (-0.52, 0.55)	0.998
3-RIR vs. FAIL (24-hrs)	0.90 (0.47, 1.32)	0.001
1-RIR vs. 3-RIR (48-hrs)	0.57 (0.08, 1.06)	0.189
1-RIR vs. FAIL (48-hrs)	-0.02 (-0.48, 0.43)	0.993
3-RIR vs. FAIL (48-hrs)	0.36 (-0.10, 0.83)	0.230

2.1.2 Descriptive Statistics (Decrease in Lifting Velocity from Pre-Exercise)

Protocol	Mean	SD
1-RIR	-0.04	0.04
3-RIR	-0.01	0.04

FAIL	-0.06	0.08
Time		
4-min	-0.09	0.06
24-hrs	-0.01	0.03
48-hrs	0.00	0.03
Protocol x Time		
1-RIR (<i>4-min</i>)	-0.09	0.03
3-RIR (<i>4-min</i>)	-0.05	0.03
FAIL (<i>4-min</i>)	-0.15	0.06
1-RIR (<i>24-hrs</i>)	-0.02	0.03
3-RIR (<i>24-hrs</i>)	0.01	0.03
FAIL (<i>24-hrs</i>)	-0.02	0.04
1-RIR (<i>48-hrs</i>)	-0.01	0.02
3-RIR (<i>48-hrs</i>)	0.01	0.02
FAIL (<i>48-hrs</i>)	0.00	0.04

2.2 Linear Mixed Effects Model [Protocol x Sex (4-min)]

Effect	DF	F-Value	P-Value
Protocol	2	89.57	<0.001
Sex	1	0.90	0.342
Protocol x Sex	2	7.14	0.001

2.2.1 Tukey's Pairwise Comparisons

Protocol x Sex	ES (CI)	P-Value
1-RIR (<i>Male vs. Female</i>)	0.10 (-0.72, 0.92)	0.834
3-RIR (<i>Male vs. Female</i>)	0.12 (-0.69, 0.94)	0.828
FAIL (<i>Male vs. Female</i>)	0.82 (-0.03, 1.67)	0.007

2.2.2 Descriptive Statistics (Decrease in Lifting Velocity from Pre-Exercise)

Protocol x Sex	Mean	SD
1-RIR (<i>Male</i>)	-0.08	0.03
1-RIR (<i>Female</i>)	-0.09	0.03
3-RIR (<i>Male</i>)	-0.04	0.02
3-RIR (<i>Female</i>)	-0.05	0.03
FAIL (<i>Male</i>)	-0.17	0.05
FAIL (<i>Female</i>)	-0.12	0.06

2.3 Within-Protocol Statistical Differences from Pre-Exercise

Protocol x Time	ES (CI)	P-Value
All Participants		
1-RIR (4-min)	0.87 (0.71, 1.02)	0.003
1-RIR (24-hrs)	0.21 (0.09, 0.33)	0.453
1-RIR (48-hrs)	0.05 (-0.04, 0.15)	0.847
3-RIR (4-min)	0.55 (0.40, 0.69)	0.056
3-RIR (24-hrs)	-0.10 (-0.23, 0.03)	0.717
3-RIR (48-hrs)	-0.10 (-0.22, 0.02)	0.712
FAIL (4-min)	1.59 (1.20, 1.98)	<0.001
FAIL (24-hrs)	0.25 (0.08, 0.43)	0.365
FAIL (48-hrs)	0.05 (-0.15, 0.25)	0.848
Male Participants		
1-RIR (4-min)	0.78 (0.57, 0.99)	0.046
1-RIR (24-hrs)	0.87 (0.71, 1.02)	0.003
1-RIR (48-hrs)	0.21 (0.09, 0.33)	0.453
3-RIR (4-min)	0.47 (0.31, 0.62)	0.219
3-RIR (24-hrs)	-0.14 (-0.29, 0.02)	0.725
3-RIR (48-hrs)	-0.15 (-0.33, 0.03)	0.693
FAIL (4-min)	1.83 (1.35, 2.30)	<0.001
FAIL (24-hrs)	0.26 (0.04, 0.48)	0.501
FAIL (48-hrs)	0.03 (-0.21, 0.27)	0.945
Female Participants		
1-RIR (4-min)	0.84 (0.62, 1.06)	0.036
1-RIR (24-hrs)	0.33 (0.15, 0.52)	0.387
1-RIR (48-hrs)	0.06 (-0.02, 0.13)	0.883
3-RIR (4-min)	0.56 (0.32, 0.81)	0.150
3-RIR (24-hrs)	-0.05 (-0.24, 0.14)	0.885
3-RIR (48-hrs)	-0.04 (-0.18, 0.11)	0.919
FAIL (4-min)	1.32 (0.77, 1.86)	0.001
FAIL (24-hrs)	0.20 (-0.05, 0.45)	0.560
FAIL (48-hrs)	0.07 (-0.23, 0.38)	0.839

S3. Lifting Velocity Loss from First to Final Set

3.1 Linear Mixed Effects Model (Protocol x Sex)

Effect	DF	F-Value	P-Value
Protocol	2	30.14	<0.001
Sex	1	6.33	0.012
Protocol x Sex	2	1.66	0.190

3.1.1 Tukey's Pairwise Comparisons

Protocol	ES (CI)	P-Value
1-RIR vs. 3-RIR	0.50 (-0.05, 1.06)	0.101
1-RIR vs. FAIL	1.46 (0.63, 2.29)	<0.001
3-RIR vs. FAIL	1.59 (1.02, 2.16)	<0.001
Sex		
Male vs. Female	0.53 (0.06, 1.00)	0.020

3.1.2 Descriptive Statistics (Decrease in Lifting Velocity from First to Final Set)

Protocol	Mean	SD
1-RIR	-0.03	0.02
3-RIR	-0.02	0.04
FAIL	-0.08	0.03
Sex		
Males	-0.05	0.04
Females	-0.03	0.04
Protocol x Sex		
1-RIR (Male)	-0.04	0.02
1-RIR (Female)	-0.03	0.02
3-RIR (Male)	-0.03	0.04
3-RIR (Female)	0.00	0.04
FAIL (Male)	-0.10	0.03
FAIL (Female)	-0.06	0.03

3.2 Within-Protocol Statistical Differences from First Set to Final Set

Protocol	ES (CI)	<i>P</i> -Value
All Participants		
1-RIR	0.85 (0.58, 1.12)	0.003
3-RIR	0.39 (0.02, 0.76)	0.168
FAIL	1.88 (1.33, 2.43)	<0.001
Male Participants		
1-RIR	0.92 (0.50, 1.33)	0.015
3-RIR	0.58 (0.10, 1.06)	0.139
FAIL	2.32 (1.58, 3.05)	<0.001
Female Participants		
1-RIR	0.69 (0.35, 1.03)	0.076
3-RIR	0.11 (-0.41, 0.64)	0.766
FAIL	1.24 (0.71, 1.76)	0.003

S4. Repetition Loss from First to Final Set

4.1 Linear Mixed Effects Model (Protocol x Sex)

Effect	DF	F-Value	P-Value
Protocol	2	64.96	<0.001
Sex	1	0.76	0.382
Protocol x Sex	2	0.26	0.775

4.1.1 Tukey's Pairwise Comparisons

Protocol	ES (CI)	P-Value
1-RIR vs. 3-RIR	1.26 (0.56, 1.97)	<0.001
1-RIR vs. FAIL	-1.31 (-1.84, -0.78)	<0.001
3-RIR vs. FAIL	2.49 (1.67, 3.30)	<0.001

4.1.2 Descriptive Statistics (% Change in Repetitions from First to Final Set)

Protocol	Mean
1-RIR	-40%
3-RIR	-27%
FAIL	-54%
Protocol x Sex	
1-RIR (<i>Male</i>)	-44%
1-RIR (<i>Female</i>)	-37%
3-RIR (<i>Male</i>)	-30%
3-RIR (<i>Female</i>)	-25%
FAIL (<i>Male</i>)	-59%
FAIL (<i>Female</i>)	-51%

4.2 Within-Protocol Statistical Differences from First Set to Final Set

Protocol	ES (CI)	<i>P</i> -Value
All Participants		
1-RIR	1.97 (1.50, 2.44)	<0.001
3-RIR	1.11 (0.73, 1.50)	<0.001
FAIL	2.64 (2.07, 3.22)	<0.001
Male Participants		
1-RIR	2.55 (1.59, 3.51)	<0.001
3-RIR	1.51 (0.63, 2.39)	<0.001
FAIL	3.72 (2.24, 5.20)	<0.001
Female Participants		
1-RIR	2.12 (1.28, 2.97)	<0.001
3-RIR	1.11 (0.54, 1.69)	0.008
FAIL	3.01 (1.93, 4.01)	<0.001

4.3 Repetitions Performed Per Set (Data Shown are Expressed as Mean $\pm$ SD)

Set	1	2	3	4	5	6
All Participants						
1-RIR	13 $\pm$ 3	11 $\pm$ 2	9 $\pm$ 2	9 $\pm$ 2	8 $\pm$ 2	8 $\pm$ 2
3-RIR	10 $\pm$ 3	9 $\pm$ 2	9 $\pm$ 2	8 $\pm$ 2	7 $\pm$ 2	7 $\pm$ 2
FAIL	14 $\pm$ 3	11 $\pm$ 3	9 $\pm$ 3	8 $\pm$ 3	7 $\pm$ 2	6 $\pm$ 2
Male Participants						
1-RIR	11 $\pm$ 2	9 $\pm$ 2	8 $\pm$ 2	7 $\pm$ 1	7 $\pm$ 1	6 $\pm$ 1
3-RIR	9 $\pm$ 2	8 $\pm$ 1	8 $\pm$ 2	7 $\pm$ 2	6 $\pm$ 1	6 $\pm$ 2
FAIL	12 $\pm$ 2	9 $\pm$ 2	7 $\pm$ 1	6 $\pm$ 2	5 $\pm$ 1	5 $\pm$ 1
Female Participants						
1-RIR	14 $\pm$ 2	12 $\pm$ 2	11 $\pm$ 2	10 $\pm$ 2	9 $\pm$ 2	9 $\pm$ 2
3-RIR	12 $\pm$ 3	11 $\pm$ 2	10 $\pm$ 2	10 $\pm$ 2	9 $\pm$ 2	9 $\pm$ 2
FAIL	16 $\pm$ 3	12 $\pm$ 3	11 $\pm$ 3	9 $\pm$ 3	8 $\pm$ 2	8 $\pm$ 2

S5. Perceived Discomfort

5.1 Friedman Test (Protocol)

Effect	DF	Chi-Squared	P-Value
Protocol	2	30.98	<0.001

5.1.1 Tukey’s Pairwise Comparisons

Protocol	ES (CI)	P-Value
1-RIR vs. 3-RIR	0.62 (0.26, 0.99)	0.005
1-RIR vs. FAIL	0.65 (0.36, 0.94)	0.001
3-RIR vs. FAIL	1.50 (1.07, 1.93)	<0.001

5.1.2 Descriptive Statistics (Rating of Perceived Discomfort)

Protocol	Mean	SD
1-RIR	3.76	1.75
3-RIR	2.74	1.17
FAIL	4.88	1.48

S6. Perceived Exertion

6.1 Friedman Test (Protocol)

Effect	DF	<i>Chi-Squared</i>	<i>P-Value</i>
Protocol	2	35.89	<0.001

6.1.1 Tukey's Pairwise Comparisons

Protocol	ES (CI)	<i>P-Value</i>
1-RIR vs. 3-RIR	1.14 (0.66, 1.63)	<0.001
1-RIR vs. FAIL	0.95 (0.37, 1.53)	0.003
3-RIR vs. FAIL	1.85 (1.12, 2.57)	<0.001

6.1.2 Descriptive Statistics (Rating of Perceived Exertion)

Protocol	Mean	<i>SD</i>
1-RIR	4.33	1.40
3-RIR	2.88	0.74
FAIL	6.04	1.99

S7. General Feelings

7.1 Friedman Test (Protocol)

Effect	DF	Chi-Squared	P-Value
Protocol	2	17.13	<0.001

7.1.1 Tukey’s Pairwise Comparisons

Protocol	ES (CI)	P-Value
1-RIR vs. 3-RIR	0.56 (0.12, 1.00)	0.025
1-RIR vs. FAIL	0.63 (0.08, 1.17)	0.071
3-RIR vs. FAIL	1.19 (0.58, 1.81)	0.001

7.1.2 Descriptive Statistics (Feeling Scale)

Protocol	Mean	SD
1-RIR	2.42	1.67
3-RIR	3.29	1.27
FAIL	1.25	1.92

S8. Muscle Soreness

8.1 Friedman Test (Protocol)

Effect	DF	Chi-Squared	P-Value
Protocol (24-hrs)	2	18.40	<0.001
Protocol (48-hrs)	2	14.08	0.001

8.1.1 Tukey’s Pairwise Comparisons

Protocol	ES (CI)	P-Value
24-hrs		
1-RIR vs. 3-RIR	0.37 (-0.20, 0.94)	0.558
1-RIR vs. FAIL	0.79 (0.19, 1.39)	0.023
3-RIR vs. FAIL	1.16 (0.64, 1.68)	<0.001
48-hrs		
1-RIR vs. 3-RIR	0.40 (-0.06, 0.87)	0.316
1-RIR vs. FAIL	0.42 (-0.17, 1.00)	0.417
3-RIR vs. FAIL	0.90 (0.31, 1.50)	0.004

8.1.2 Descriptive Statistics (Rating of Muscle Soreness)

Protocol	Mean	SD
24-hrs		
1-RIR	2.29	1.71
3-RIR	1.67	1.52
FAIL	3.79	1.96
48-hrs		
1-RIR	1.5	2
3-RIR	0.79	1.14
FAIL	2.38	2.06

S9. Perceived Recovery

9.1 Friedman Test (Protocol)

Effect	DF	Chi-Squared	P-Value
Protocol (24-hrs)	2	21.30	<0.001
Protocol (48-hrs)	2	12.83	0.002

9.1.1 Tukey's Pairwise Comparisons

Protocol	ES (CI)	P-Value
24-hrs		
1-RIR vs. 3-RIR	0.75 (0.21, 1.29)	0.014
1-RIR vs. FAIL	0.52 (-0.05, 1.08)	0.204
3-RIR vs. FAIL	1.55 (0.83, 2.27)	0.001
48-hrs		
1-RIR vs. 3-RIR	0.66 (0.25, 1.06)	0.008
1-RIR vs. FAIL	0.24 (-0.33, 0.81)	0.659
3-RIR vs. FAIL	1.02 (0.45, 1.58)	0.003

9.1.2 Descriptive Statistics (Rating of Perceived Recovery Status)

Protocol	Mean	SD
24-hrs		
1-RIR	3.83	2.20
3-RIR	5.42	1.84
FAIL	2.88	1.23
48-hrs		
1-RIR	5.83	2.28
3-RIR	7.21	1.47
FAIL	5.29	2.07