

THE EFFECTS OF PLYOMETRIC TRAINING VOLUME ON JUMP PERFORMANCE USING 6-WEEK PLYOMETRIC TRAINING PROGRAM

Cameron D. Addie¹, Jennifer L. Caputo², Dana K. Fuller², Jocelyn E. Arnett³, Samantha L. Johnson²

¹Department of Exercise Science, Emory and Henry College – Meadowview, VA, USA

²Department of Health and Human Performance, Middle Tennessee State University – Murfreesboro, TN, USA

³Department of Nutrition and Health Sciences, University of Nebraska – Lincoln, Lincoln, NE, USA

PURPOSE

Varying training volumes can be used to achieve specific performance goals so that programs can be tailored to suit individuals with different needs, abilities, and backgrounds. Therefore, the purpose of this study was to compare the impact of plyometric training (PT) volume during a 6-week PT program on changes in horizontal and vertical lower body power by assessing changes in broad jump (BJ), squat jump (SJ), countermovement jump (CMJ), and approach jump (AJ) performance in physically active individuals (PAI).

METHODS

Twelve physically active males were randomly assigned to either a moderate-volume (n = 6) or high-volume (n = 6) plyometric training (PT) group based on their order of recruitment. Participants completed informed consent and screening forms before beginning the study. Body mass and height were measured, and participants completed a standardized warm-up before undergoing familiarization with jump testing protocols that included the SJ, CMJ, AJ, and BJ. Each jump was demonstrated and practiced prior to pre-testing, which was conducted on a hardwood gym floor. Following a 2-week accommodation period to practice proper form and technique, participants completed a 6-week PT program with two supervised sessions per week. Both groups performed the same plyometric exercises, however, the moderate-volume group completed 90-140 foot contacts per session while the high-volume group completed 115-180 foot contacts per session. Each training session included a dynamic warm-up and the prescribed exercises with structured rest intervals. Pre- and post-testing took place 24–72 hours before and after the PT. Statistical analysis used repeated measures ANOVAs to assess performance changes in each jump between groups and across time, with significance set at $p \leq .05$.

RESULTS

Broad Jump: The results of the repeated measures ANOVA for BJ indicated no significant 2-way interaction ($F_{1,10} = 0.09$, $p = .767$, $\eta_p^2 = .01$). There was, however, significant main effects for time ($F_{1,10} = 22.12$, $p = .001$, $\eta_p^2 = .69$, $d = 0.73$) and volume ($F_{1,10} = 4.98$, $p = .050$, $\eta_p^2 = .33$, $d = 1.29$; see Table 2).

Squat Jump: The results of repeated measures ANOVA for SJ indicated no significant 2-way interaction ($F_{1,10} = 2.92$, $p = .118$, $\eta_p^2 = .23$). In addition, there were no significant main effects for time ($F_{1,10} = 3.46$, $p = .093$, $\eta_p^2 = .26$) or volume ($F_{1,10} = 0.04$, $p = .844$, $\eta_p^2 = .004$; see Table 2).

Counter-Movement Jump: The results of the repeated measures ANOVA for CMJ indicated no significant 2-way interaction ($F_{1,10} = 2.02$, $p = .186$, $\eta_p^2 = .17$) and no significant main effect for volume ($F_{1,10} = 0.34$, $p = .573$, $\eta_p^2 = .03$). There was a significant main effect for time ($F_{1,10} = 7.62$, $p = .020$, $\eta_p^2 = .43$, $d = 0.18$ see Table 2).

Approach Jump: The repeated measures ANOVA for AJ indicated no significant 2-way interaction ($F_{1,10} = 0.08$, $p = .783$, $\eta_p^2 = .01$) and no significant main effect for volume ($F_{1,10} = 0.53$, $p = .482$, $\eta_p^2 = .05$). There was a significant main effect for time ($F_{1,10} = 54.64$, $p < .001$, $\eta_p^2 = .85$, $d = 0.53$ see Table 2).

CONTACT INFORMATION

Cameron D. Addie, PhD, CSCS, ACSM-EP
Assistant Professors of Exercise Science
cdaddie@emoryhenry.edu
Emory & Henry University
PO Box 947
Emory, Virginia 24327
T: 859.630.8588

School of Health Sciences EMORY & HENRY COLLEGE



Both moderate- and high-volume PT improved jump performance similarly suggesting that moderate-volume PT programs are as effective as high-volume PT programs. Lack of SJ improvement suggests the need for specific and technique-focused training.

| Week | Volume (Foot Contacts) | | Plyometric Exercises | Sets x Reps | |
|------|------------------------|------|--|-------------|--------|
| | Moderate | High | | Moderate | High |
| 1 | 90 | 115 | Lateral ankle hops* | 2 x 15 | 3 X 15 |
| | | | Counter-movement jump* | 2 x 15 | 3 X 15 |
| | | | Front barrier jumps* | 5 x 6 | 5 X 5 |
| 2 | 120 | 150 | Lateral ankle hops* | 2 x 15 | 3 X 15 |
| | | | Standing long jump* | 5 x 6 | 5 X 6 |
| | | | Lateral barrier jumps** | 2 x 15 | 3 X 15 |
| 3 | 120 | 150 | Tuck jumps** | 5 x 6 | 5 X 6 |
| | | | Lateral ankle hops* | 2 x 12 | 3 X 10 |
| | | | Standing long jump* | 4 x 6 | 3 X 10 |
| 4 | 140 | 180 | Lateral barrier jumps** | 2 x 12 | 3 X 10 |
| | | | Tuck jumps** | 3 x 8 | 3 X 10 |
| | | | Lateral barrier jumps** | 2 x 12 | 3 X 10 |
| 5 | 140 | 180 | Diagonal barrier jumps* | 4 x 8 | 4 X 10 |
| | | | Standing long jump with lateral sprint** | 4 x 8 | 4 X 10 |
| | | | Lateral barrier jumps** | 2 x 12 | 2 X 12 |
| 6 | 120 | 150 | Single leg bound*** | 4 x 7 | 5 X 7 |
| | | | Side to side unilateral jumps*** | 4 x 6 | 6 X 6 |
| | | | Diagonal barrier jumps* | 2 x 7 | 4 X 7 |
| 7 | 120 | 150 | Standing long jump with lateral sprint** | 4 x 7 | 4 X 8 |
| | | | Lateral barrier jumps** | 4 x 7 | 4 X 7 |
| | | | Barrier jumps with half turn** | 4 x 7 | 4 X 8 |
| 8 | 120 | 150 | Single leg bound*** | 4 x 7 | 4 X 8 |
| | | | Side to side unilateral jumps*** | 2 x 7 | 4 X 7 |
| | | | Diagonal barrier jumps* | 2 x 12 | 3 X 10 |
| 9 | 120 | 150 | Hexagon drill* | 2 x 12 | 2 X 12 |
| | | | Barrier jumps with directional sprints** | 4 x 6 | 5 X 6 |
| | | | Tuck jumps** | 3 x 8 | 5 X 8 |
| 10 | 120 | 150 | Side to side unilateral jumps*** | 4 x 6 | 5 X 6 |

Note. * = low intensity; ** = medium intensity; *** = high intensity.

CONCLUSION

- Moderate- to high-volume PT improves BJ, CMJ, and AJ performance in PAI
- Higher volume is not necessary for enhanced performance and may not be ideal for all individuals
- No improvements were observed in squat jump (SJ) for either group. Possible reasons include lack of specificity in training and poor technique
- Practitioners can achieve similar performance outcomes with lower volume, making programs more time-efficient and decrease the risk of injury.

PRACTICAL APPLICATION

Broadening Applicability

- Results encourage broader adoption of PT programs in general fitness settings to improve lower-body power.

Exercise Prescription & Individualization

- Avoiding unnecessarily high volume may help reduce fatigue, overuse injuries, or overtraining, particularly in novice or recreational athletes.

Specificity & Jump Type Focus

- Programs should target movement patterns and neuromuscular demands relevant to the desired jump outcome (e.g., static vs. dynamic jumps).

Table 2. Descriptive statistics for performance outcomes based on training volume (cm).

| Variable | Moderate Volume | | High Volume | | All Volumes | |
|------------------------|-----------------|------|-------------|------|-------------|------|
| | Mean | SD | Mean | SD | Mean | SD |
| Broad jump* | | | | | | |
| Pre | 226.2 | 13.8 | 245.2 | 16.0 | 235.7 | 14.9 |
| Post | 239.5 | 9.7 | 256.9 | 14.0 | 248.2* | 12.8 |
| Post-Pre | 13.3 | | 11.7 | | | |
| All Times | 232.8 | 11.8 | 251.0 | 15.0 | | |
| Squat jump | | | | | | |
| Pre | 55.7 | 10.0 | 59.0 | 5.1 | 57.3 | 7.6 |
| Post | 60.2 | 11.2 | 59.2 | 8.6 | 59.7 | 9.9 |
| Post-Pre | 4.6 | | 0.2 | | | |
| All Times | | | | | | |
| Counter-movement jump* | | | | | | |
| Pre | 61.9 | 9.5 | 65.9 | 7.1 | 63.9 | 8.3 |
| Post | 64.4 | 9.5 | 66.7 | 7.9 | 65.5* | 8.7 |
| Post-pre | 2.5 | | 0.8 | | | |
| All Times | | | | | | |
| Approach jump* | | | | | | |
| Pre | 66.0 | 10.5 | 70.1 | 6.7 | 68.1 | 8.6 |
| Post | 71.1 | 9.7 | 74.9 | 7.2 | 73.0* | 8.5 |
| Post-Pre | 5.1 | | 4.8 | | | |
| All Times | | | | | | |

Note. *Post-test jump height significantly greater ($p < .05$) than pre-test jump height.