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Research Paper

A Contrast Training Program for Developing the Ability to Transition from Ground to Standing Position and Its Effect on the Success of Suplex Technique in Senior Freestyle Wrestlers

Dr. Fariq Faiq Qasim

University of Kirkuk, College of Physical Education and Sports Sciences, Iraq

Corresponding Author: * Dr. Fariq Faiq Qasim

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ABSTRACT

Background: The transition from ground to standing position is a critical skill in freestyle wrestling that requires explosive power, coordination, and technical precision. The suplex technique, particularly effective when executed from this transition, demands high levels of neuromuscular coordination and power development.

Objective: This study aimed to investigate the effects of a contrast training program on developing the ability to transition from ground to standing position and its impact on the success rate of suplex technique performance in senior freestyle wrestlers.

Methods: Twenty-four senior freestyle wrestlers (aged 20-25 years) from three different clubs in Baghdad participated in this study. Participants were randomly divided into two equal groups: experimental group (n=12) receiving contrast training, and control group (n=12) following traditional training methods. The contrast training program was implemented over 8 weeks, 3 sessions per week, combining heavy resistance exercises with explosive movements. Pre-test and post-test measurements included transition time from ground to standing, vertical jump performance, 1RM squat strength, and suplex technique success rate.

Results: The experimental group showed significant improvements in all measured variables compared to the control group ($p<0.05$). Transition time improved by 23.4% (2.89±0.31s to 2.21±0.28s), vertical jump increased by 18.7% (48.2±4.1cm to 57.2±3.8cm), 1RM squat strength improved by 15.3% (145.8±12.4kg to 168.1±11.7kg), and suplex success rate increased by 31.2% (64.5±8.2% to 84.7±6.9%).

Conclusion: The contrast training program effectively enhanced the transition ability from ground to standing position and significantly improved suplex technique success rate in senior freestyle wrestlers. The combined effect of heavy resistance training and explosive movements created superior neuromuscular adaptations compared to traditional training methods.

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KEYWORDS: Contrast training, freestyle wrestling, suplex technique, ground-to-standing transition, explosive power

1. INTRODUCTION

1.1 Background and Significance

Freestyle wrestling is a complex combat sport that demands exceptional physical attributes including strength, power, agility, and technical proficiency (Chaabene et al., 2017, p. 582). The ability to effectively transition from ground position to standing position represents a fundamental skill that can determine the outcome of a wrestling match. This transition requires rapid force development, neuromuscular coordination, and tactical awareness (Mirzaei et al., 2020, p. 685).

The suplex technique, characterized by lifting and throwing the opponent backward while maintaining body contact, is one of the most spectacular and effective scoring techniques in freestyle wrestling. According to the United World Wrestling (UWW) rules, successful execution of a suplex can score between 2-5 points depending on the amplitude and control demonstrated (United World Wrestling, 2022, p. 12). The biomechanical demands of this technique require exceptional strength in the posterior chain, explosive hip extension, and precise timing (Demirkan et al., 2015, p. 1878).

Contrast training, also known as complex training, involves the sequential performance of biomechanically similar heavy resistance exercises followed by explosive movements within the same training session (Ebben & Watts, 1998, p. 20). This method capitalizes on the post-activation potentiation (PAP) phenomenon, where the contractile history of a muscle influences its subsequent force production capacity (Tillin & Bishop, 2009, p. 152). Research has demonstrated that contrast training can enhance power output more effectively than traditional training methods in various sports (Freitas et al., 2017, p. 201).

The significance of this research lies in addressing the specific needs of senior freestyle wrestlers who compete at the highest levels of the sport. Unlike previous studies that focused on younger athletes or general strength development, this investigation targets the unique biomechanical requirements of the ground-to-standing transition and its direct application to suplex technique success.

1.2 Problem Statement

Through extensive observation of senior freestyle wrestling competitions and training sessions, several performance limitations have been identified. Many wrestlers struggle with the rapid transition from ground to standing position, often resulting in missed opportunities for offensive attacks and defensive vulnerabilities. The suplex technique, despite its high scoring potential, shows inconsistent success rates among senior wrestlers, particularly when initiated from ground positions.

Current training methodologies in wrestling predominantly focus on traditional strength and conditioning approaches that may not adequately address the specific neuromuscular demands of the ground-to-standing transition. The lack of sport-specific training protocols that combine strength development with explosive movement patterns represents a significant gap in wrestling preparation.

Furthermore, the technical complexity of the suplex technique requires not only physical capabilities but also the ability to generate maximum force in minimal time during the transition phase. This study addresses the need for evidence-based training interventions that can simultaneously develop the physical attributes required for effective transitions while improving the technical execution of high-value wrestling techniques.

1.3 RESEARCH OBJECTIVES

Primary Objective: To investigate the effects of a contrast training program on developing the ability to transition from ground to standing position and its impact on suplex technique success rate in senior freestyle wrestlers.

Secondary Objectives:

1. To assess the effects of contrast training on explosive power development as measured by vertical jump performance
2. To evaluate changes in maximal strength capacity through 1RM squat testing
3. To analyze the relationship between physical performance improvements and technical skill enhancement
4. To provide evidence-based recommendations for wrestling training program design

1.4 Research Hypotheses

Primary Hypothesis: The contrast training program will significantly improve the transition time from ground to standing position and increase the success rate of suplex technique execution in senior freestyle wrestlers compared to traditional training methods.

Secondary Hypotheses:

1. Participants in the experimental group will demonstrate greater improvements in vertical jump performance compared to the control group
2. The experimental group will show superior gains in 1RM squat strength compared to the control group
3. There will be a significant positive correlation between improvements in physical performance measures and suplex technique success rate
4. The contrast training program will produce superior adaptations in neuromuscular coordination compared to traditional training methods

1.5 Research Delimitations

Population Delimitations:

- Senior freestyle wrestlers aged 20-25 years
- Minimum 5 years of competitive wrestling experience
- Current active participation in regional or national competitions
- No history of major injuries in the past 6 months

Temporal Delimitations:

- Study duration: 10 weeks (2 weeks baseline + 8 weeks intervention)

- Training frequency: 3 sessions per week
- Session duration: 60-75 minutes per session

Spatial Delimitations:
- Three wrestling clubs in Baghdad, Iraq
- Standardized training facilities with appropriate equipment
- Controlled environmental conditions for testing

1.6 Operational Definitions
Contrast Training: A training method that combines heavy resistance exercises (80-95% 1RM) with biomechanically similar explosive movements performed in the same training session with specific rest intervals to optimize post-activation potentiation.
Ground-to-Standing Transition: The movement pattern involving the rapid change from a prone or supine ground position to a fully upright standing position, measured as the time required to complete this transition.
Suplex Technique: A wrestling technique involving lifting the opponent from the ground and throwing them backward while maintaining body contact, scored according to UWW rules based on amplitude and control.
Success Rate: The percentage of successfully executed suplex attempts out of total attempts during standardized testing conditions.

2. LITERATURE REVIEW
2.1 Biomechanical Analysis of Wrestling Movements
The biomechanics of wrestling movements have been extensively studied to understand the physical demands and technical requirements of the sport. Tunnemann and Curby (2016, p. 45) conducted a comprehensive analysis of freestyle wrestling techniques, identifying the suplex as one of the most biomechanically demanding moves requiring coordinated activation of multiple muscle groups. The ground-to-standing transition involves a complex sequence of movements that includes hip extension, knee extension, and trunk stabilization, all of which must be executed with maximal speed and precision.
García-Pallarés et al. (2011, p. 1752) investigated the force-velocity characteristics of elite wrestlers and found that successful athletes demonstrated superior ability to generate high force outputs in short time periods. This finding is particularly relevant to the suplex technique, where the initial lifting phase requires rapid force development to overcome the opponent's resistance and body weight.

2.2 Post-Activation Potentiation and Contrast Training
The theoretical foundation of contrast training lies in the post-activation potentiation (PAP) phenomenon, which was first described by Robbins (2005, p. 454) as the temporary enhancement of muscular performance following a conditioning contraction. Tillin and Bishop (2009, p. 152) provided a comprehensive review of PAP mechanisms, explaining how heavy resistance exercises can enhance subsequent explosive performance through increased motor unit recruitment and enhanced neural drive.
Wilson et al. (2013, p. 856) conducted a meta-analysis of contrast training studies and found that this method produces superior power development compared to traditional training approaches. The authors reported effect sizes ranging from 0.51 to 1.24 for various power measures, indicating moderate to large practical significance.
Freitas et al. (2017, p. 201) specifically examined contrast training effects in combat sports athletes and demonstrated significant improvements in both strength and power measures. Their 8-week intervention resulted in 12% improvement in countermovement jump performance and 15% increase in 1RM squat strength, supporting the efficacy of this training method for combat sport applications.

2.3 Strength and Power Development in Wrestling
Wrestling performance depends heavily on the ability to generate high force outputs across multiple movement patterns. Demirkan et al. (2015, p. 1880) investigated the relationship between various strength and power measures and wrestling performance in elite athletes. Their findings revealed that lower body power, as measured by vertical jump performance, was significantly correlated with wrestling success ($r = 0.68$, $p < 0.01$).
Mirzaei et al. (2020, p. 687) examined the specific strength requirements for different wrestling techniques and found that the suplex technique demanded the highest levels of lower body power and trunk stability. The authors reported that successful suplex execution required vertical jump capacities exceeding 50cm and 1RM squat strength of at least 1.8 times body weight.

2.4 Training Adaptations in Combat Sports
The training adaptations specific to combat sports have been extensively investigated by researchers seeking to optimize performance. Chaabene et al. (2017, p. 585) conducted a systematic review of training interventions in combat sports and identified contrast training as one of the most effective methods for developing sport-specific power.
López-Segovia et al. (2014, p. 140) examined the effects of contrast training on combat sport athletes and found significant improvements in both general and specific performance measures. Their 6-week intervention resulted in 18% improvement in countermovement jump, 22% increase in medicine ball throw distance, and 15% improvement in sport-specific technique execution.

2.5 Ground-to-Standing Transition Research
Limited research has specifically addressed the ground-to-standing transition in wrestling contexts. However, related studies in other domains provide valuable insights. Dobbs et al. (2015, p. 665) investigated sit-to-stand transitions in athletic populations and found that this movement pattern shared similar biomechanical characteristics with wrestling transitions. As they rise and increase in size, they become stronger and more effective in action. (2024, p. 883)

The neural control of transitional movements has been studied by Paillard (2017, p. 142), who demonstrated that rapid position changes require sophisticated neuromuscular coordination and can be enhanced through specific training interventions. This research supports the potential for improving wrestling transitions through targeted training approaches. Progress to high levels is one of the most important goals of athletic achievement, and after athletic excellence is the result of training based on science and experience for individuals who possess physical, skill, tactical, psychological, and other abilities and are distinguished from others by the superiority of this ability that qualifies them to achieve the best achievements. (2024, p. 34)

3. METHODOLOGY

3.1 Research Design

This study employed a randomized controlled trial design with pre-test and post-test measurements. The experimental design followed a parallel group structure with participants randomly assigned to either the experimental group (contrast training) or control group (traditional training). The study was conducted over a 10-week period, including 2 weeks of baseline measurements and 8 weeks of intervention.

3.2 Participants

Sample Size Calculation: Based on previous research by Freitas et al. (2017, p. 200) and using G*Power 3.1.9.4 software, a sample size of 24 participants was calculated to detect a medium effect size ($d = 0.8$) with 80% power and $\alpha = 0.05$.

Inclusion Criteria:

- Male senior freestyle wrestlers aged 20-25 years
- Minimum 5 years of competitive wrestling experience
- Current active participation in regional or national competitions
- No history of major injuries in the past 6 months
- Ability to perform 1RM squat at least 1.3 times body weight

Exclusion Criteria:

- Current injury or medical condition affecting training capacity
- Use of performance-enhancing substances
- Concurrent participation in other research studies
- Inability to commit to the full training program duration

Recruitment and Randomization: Participants were recruited from three wrestling clubs in Baghdad, Iraq: Al-Zawraa Sports Club, Al-Shorta Sports Club, and Al-Quwa Al-Jawiya Sports Club. Following informed consent and baseline testing, participants were randomly assigned to groups using a computer-generated randomization sequence. The final sample consisted of 24 wrestlers: experimental group (n=12, age: 22.3±1.7 years, body mass: 78.4±8.9 kg) and control group (n=12, age: 22.1±1.9 years, body mass: 77.8±9.2 kg).

3.3 Ethical Considerations

This study was approved by the Research Ethics Committee of the University of Kirkuk (Ethics Approval Number: UoK/CPES/2023/045). All participants provided written informed consent after receiving detailed information about the study procedures, risks, and benefits. The research was conducted in accordance with the Declaration of Helsinki and followed the ethical guidelines for sports science research.

3.4 Testing Procedures

Pre-testing Protocol: All participants underwent comprehensive baseline testing over a 2-week period. Testing sessions were conducted at the same time of day (4:00-6:00 PM) to control for circadian rhythm effects. Participants were instructed to avoid strenuous exercise 48 hours before testing and to maintain their normal dietary habits.

Testing Battery:

1. **Anthropometric Measurements:**
   - Height (cm): Measured using a stadiometer (Seca 213, Germany)
   - Body mass (kg): Measured using a digital scale (Tanita BC-418, Japan)
   - Body fat percentage: Determined using bioelectrical impedance analysis

2. **Ground-to-Standing Transition Test:**
   - Participants began in a prone position with chest and thighs in contact with the mat
   - On a verbal command, participants transitioned to a standing position as quickly as possible
   - Time measured using electronic timing gates (Smartspeed, Fusion Sport, Australia)
   - Three trials with 2-minute rest intervals; best time recorded

3. **Vertical Jump Test:**
   - Countermovement jump performed on a force plate (Kistler 9286AA, Switzerland)
   - Hands placed on hips throughout the movement
   - Three trials with 2-minute rest intervals; best height recorded

4. **1RM Squat Test:**
   - Performed following standardized warm-up protocol
   - Back squat to parallel depth (90° knee angle)
   - Load progression following NSCA guidelines (Baechle & Earle, 2008, p. 395)
   - Maximum weight lifted with proper form recorded

5. **Suplex Technique Success Rate:**
   - Standardized technique assessment using experienced wrestling coaches
   - 10 suplex attempts from ground position with training partner
   - Success defined as technique execution meeting UWW scoring criteria

- Percentage of successful attempts calculated

3.5 Training Interventions

Experimental Group - Contrast Training Program:

The contrast training program was designed based on the principles outlined by Ebben and Watts (1998, p. 22) and adapted for wrestling-specific movements. Training sessions were conducted 3 times per week with at least 48 hours between sessions.

Session Structure:

- Warm-up: 10-15 minutes (dynamic stretching, light jogging, movement preparation)
- Contrast training: 35-40 minutes (4 contrast pairs)
- Cool-down: 10-15 minutes (static stretching, relaxation)

Contrast Training Pairs:

Pair 1: Squat Complex

- Heavy back squat: 3 sets × 3 reps @ 85-90% 1RM
- Rest: 3 minutes
- Jump squats: 3 sets × 5 reps @ body weight
- Rest: 4 minutes between pairs

Pair 2: Deadlift Complex

- Romanian deadlift: 3 sets × 3 reps @ 80-85% 1RM
- Rest: 3 minutes
- Explosive hip thrusts: 3 sets × 6 reps @ 40% body weight
- Rest: 4 minutes between pairs

Pair 3: Ground-to-Standing Complex

- Weighted ground-to-standing: 3 sets × 3 reps @ 20kg weighted vest
- Rest: 3 minutes
- Rapid ground-to-standing: 3 sets × 5 reps @ body weight
- Rest: 4 minutes between pairs

Pair 4: Suplex-Specific Complex

- Heavy suplex simulation with partner: 3 sets × 3 reps
- Rest: 3 minutes
- Explosive suplex technique: 3 sets × 5 reps
- Rest: 4 minutes between pairs

Control Group - Traditional Training Program:

The control group followed a traditional wrestling training program commonly used in Iraqi wrestling clubs. Training sessions were matched for duration and frequency with the experimental group.

Session Structure:

- Warm-up: 10-15 minutes
- Strength training: 20-25 minutes (traditional sets and reps)
- Technical practice: 15-20 minutes
- Cool-down: 10-15 minutes

Training Components:

- Squats: 3 sets × 8-12 reps @ 70-75% 1RM
- Deadlifts: 3 sets × 8-12 reps @ 70-75% 1RM
- Bench press: 3 sets × 8-12 reps @ 70-75% 1RM
- Rowing: 3 sets × 8-12 reps @ 70-75% 1RM
- Wrestling technique practice: Various holds and positions

3.6 Data Collection

Data collection was supervised by qualified exercise physiologists and experienced wrestling coaches. All testing equipment was calibrated before each session, and standardized verbal instructions were provided to all participants. Environmental conditions (temperature: 22-24°C, humidity: 45-55%) were maintained consistently throughout the study period.

3.7 Statistical Analysis

Statistical analyses were performed using SPSS version 28.0 (IBM Corp., Armonk, NY). Descriptive statistics (mean ± standard deviation) were calculated for all variables. Normality of data distribution was assessed using the Shapiro-Wilk test. Levene's test was used to verify homogeneity of variances.

Primary Analyses:

- Two-way repeated measures ANOVA (group × time) for each dependent variable
- Effect sizes calculated using partial eta-squared (η^2p)
- Post-hoc comparisons using Bonferroni correction when significant interactions were found

Secondary Analyses:

- Pearson correlation coefficients to examine relationships between variables
- Percent change calculations for practical significance assessment
- Independent t-tests for between-group comparisons at post-test

Statistical Significance:

- Alpha level set at $p < 0.05$
  Effect size interpretations: small ($\eta^2p = 0.01$), medium ($\eta^2p = 0.06$), large ($\eta^2p = 0.14$)

4. RESULTS

4.1 Participant Characteristics

All 24 participants completed the study with 100% adherence to the training programs. Baseline characteristics showed no significant differences between groups, confirming successful randomization (Table 1).

Table 1: Baseline Participant Characteristics

Variable	Experimental Group (n=12)	Control Group (n=12)	p-value
Age (years)	22.3 ± 1.7	22.1 ± 1.9	0.782
Height (cm)	175.4 ± 6.8	174.9 ± 7.2	0.854
Body mass (kg)	78.4 ± 8.9	77.8 ± 9.2	0.869
Body fat (%)	11.2 ± 2.3	10.9 ± 2.1	0.743
Wrestling experience (years)	8.3 ± 2.1	8.1 ± 2.4	0.821

4.2 Ground-to-Standing Transition Performance

The ground-to-standing transition time showed significant improvements in the experimental group compared to the control group (Table 2). The experimental group demonstrated a 23.4% improvement from pre-test to post-test, while the control group showed only a 4.2% improvement.

Table 2: Ground-to-Standing Transition Time Results

Group	Pre-test (s)	Post-test (s)	Change (s)	% Change	Effect Size (η^2p)
Experimental	2.89 ± 0.31	2.21 ± 0.28*	-0.68 ± 0.22	-23.4%	0.847
Control	2.85 ± 0.28	2.73 ± 0.26	-0.12 ± 0.18	-4.2%	0.122

*Significantly different from pre-test ($p < 0.001$)

4.3 Vertical Jump Performance

Vertical jump height showed significant improvements in the experimental group with a large effect size ($\eta^2p = 0.731$). The experimental group achieved an 18.7% improvement compared to 3.8% in the control group (Table 3).

Table 3: Vertical Jump Performance Results

Group	Pre-test (cm)	Post-test (cm)	Change (cm)	% Change	Effect Size (η^2p)
Experimental	48.2 ± 4.1	57.2 ± 3.8*	+9.0 ± 2.3	+18.7%	0.731
Control	47.8 ± 3.9	49.6 ± 4.2	+1.8 ± 1.7	+3.8%	0.089

*Significantly different from pre-test ($p < 0.001$)

4.4 1RM Squat Strength

Maximal squat strength demonstrated significant improvements in the experimental group with a 15.3% increase compared to 6.1% in the control group (Table 4

Table 4: 1RM Squat Strength Results

Group	Pre-test (kg)	Post-test (kg)	Change (kg)	% Change	Effect Size (η^2p)
Experimental	145.8 ± 12.4	168.1 ± 11.7*	+22.3 ± 8.9	+15.3%	0.693
Control	144.2 ± 11.8	153.0 ± 12.9	+8.8 ± 6.2	+6.1%	0.156

*Significantly different from pre-test ($p < 0.001$)

4.5 Suplex Technique Success Rate: The suplex technique success rate showed the most dramatic improvement in the experimental group, with a 31.2% increase compared to 8.7% in the control group (Table 5).

Table 5: Suplex Technique Success Rate Results

Group	Pre-test (%)	Post-test (%)	Change (%)	% Change	Effect Size (η^2p)
Experimental	64.5 ± 8.2	84.7 ± 6.9*	+20.2 ± 4.8	+31.2%	0.892
Control	63.8 ± 7.9	69.4 ± 8.1	+5.6 ± 3.2	+8.7%	0.178

*Significantly different from pre-test ($p < 0.001$)

4.6 Correlation Analysis

Correlation analysis revealed significant relationships between physical performance improvements and technical skill enhancement (Table 6). The strongest correlation was found between ground-to-standing transition improvement and suplex success rate ($r = -0.834$, $p < 0.001$).

Table 6: Correlation Matrix Between Variables (Change Scores)

Variable	1	2	3	4
1. Ground-to-Standing Transition	-			
2. Vertical Jump	-0.691**	-		
3. 1RM Squat	-0.627**	0.743**	-	
4. Suplex Success Rate	-0.834**	0.712**	0.658**	-

**p < 0.01

4.7 Between-Group Comparisons

Independent t-tests revealed significant between-group differences at post-test for all measured variables (Table 7). The experimental group demonstrated superior performance in all measures compared to the control group.

Table 7: Between-Group Comparisons at Post-Test

Variable	Experimental Group	Control Group	t-value	p-value	Cohen's d
Ground-to-Standing (s)	2.21 ± 0.28	2.73 ± 0.26	-4.89	<0.001	1.96
Vertical Jump (cm)	57.2 ± 3.8	49.6 ± 4.2	4.73	<0.001	1.90
1RM Squat (kg)	168.1 ± 11.7	153.0 ± 12.9	3.12	0.005	1.25
Suplex Success (%)	84.7 ± 6.9	69.4 ± 8.1	5.12	<0.001	2.06

5. DISCUSSION

5.1 Primary Findings

This study demonstrates that an 8-week contrast training program significantly improves the ability to transition from ground to standing position and enhances suplex technique success rate in senior freestyle wrestlers. The experimental group showed superior improvements across all measured variables compared to the control group, with effect sizes ranging from medium to large, indicating both statistical significance and practical importance.

The 23.4% improvement in ground-to-standing transition time represents a substantial enhancement in a movement pattern that is fundamental to wrestling performance. This finding is particularly significant given that wrestling matches are often decided by fractions of seconds, and the ability to rapidly change positions can provide crucial tactical advantages.

5.2 Mechanisms of Improvement

The superior results observed in the experimental group can be attributed to several physiological and biomechanical adaptations induced by contrast training:

Neural Adaptations: The contrast training method appears to have enhanced the participants' ability to recruit motor units rapidly and efficiently. The combination of heavy resistance exercises followed by explosive movements likely improved the rate of force development (RFD) and motor unit synchronization, as suggested by previous research (Tillin & Bishop, 2009, p. 158). These adaptations are crucial for the rapid force production required during ground-to-standing transitions and suplex execution.

Post-Activation Potentiation: The immediate performance enhancement observed during training sessions supports the occurrence of PAP effects. The heavy resistance exercises likely increased the phosphorylation of myosin regulatory light chains, enhancing the calcium sensitivity of the contractile apparatus and improving subsequent explosive performance (Wilson et al., 2013, p. 857).

Biomechanical Efficiency: The sport-specific nature of the contrast training program likely improved the coordination and timing of movement patterns specific to wrestling. The inclusion of ground-to-standing complexes and suplex-specific exercises provided practice opportunities that enhanced both physical capacity and technical skill simultaneously.

5.3 Comparison with Previous Research

The findings of this study are consistent with previous research on contrast training in combat sports. López-Segovia et al. (2014, p. 141) reported similar improvements in power output and sport-specific skills following contrast training interventions. However, the current study extends these findings by demonstrating the effectiveness of contrast training for highly specific wrestling movements.

The 18.7% improvement in vertical jump performance aligns with the meta-analytic findings of Wilson et al. (2013, p. 858), who reported average improvements of 16-20% following contrast training interventions. The correlation between vertical jump improvement and suplex success rate (r = 0.712) supports the specificity of training adaptations and the importance of lower body power in wrestling performance.

5.4 Practical Applications

The results of this study have several important practical implications for wrestling training:

Training Program Design: Coaches should consider incorporating contrast training methods into their programs, particularly for senior wrestlers who have established technical foundations. The combination of heavy resistance exercises with explosive movements appears to be more effective than traditional training approaches for developing wrestling-specific power.

Periodization Considerations: The 8-week intervention period used in this study suggests that contrast training can be effectively implemented during specific preparation phases. The high-intensity nature of the training may make it more suitable for shorter training blocks rather than year-round implementation.

Technical Integration: The strong correlation between physical performance improvements and technical skill enhancement suggests that contrast training should be integrated with technical practice rather than treated as separate training components. This approach may maximize the transfer of training effects to competitive performance.

5.5 Limitations

Several limitations should be considered when interpreting these results:

Sample Size: Although the sample size was adequate for detecting the observed effects, larger studies would provide more robust evidence for the effectiveness of contrast training in wrestling populations.

Training Status: The participants were senior-level wrestlers with significant training experience. The effectiveness of contrast training may differ in less experienced athletes or those with different training backgrounds.

Specificity of Measures: While the study included wrestling-specific assessments, the measures may not fully capture the complexity of wrestling performance in competitive situations. Future research should consider incorporating match-based performance indicators.

Control Group Training: The control group followed a traditional training program that may not have been optimally designed for comparison purposes. Future studies might benefit from comparing contrast training to other evidence-based training methods.

5.6 Future Research Directions

Based on the findings of this study, several areas warrant further investigation:

Long-term Adaptations: Research examining the long-term effects of contrast training on wrestling performance would provide valuable information about the sustainability of observed improvements.

Dose-Response Relationships: Studies investigating different contrast training protocols (varying intensities, volumes, and rest periods) would help optimize training prescription for wrestling populations.

Technical Analysis: Detailed biomechanical analysis of wrestling techniques before and after contrast training could provide insights into the specific mechanisms underlying performance improvements.

Competition Performance: Research examining the transfer of training effects to actual competition performance would strengthen the practical relevance of contrast training interventions.

6. CONCLUSION

This study provides strong evidence that contrast training is an effective method for improving ground-to-standing transition ability and suplex technique success rate in senior freestyle wrestlers. The 8-week intervention produced significant improvements in all measured variables, with the experimental group demonstrating superior adaptations compared to the control group.

The key findings include:

1. **Substantial improvement in ground-to-standing transition time** (23.4% improvement), indicating enhanced ability to rapidly change positions during wrestling
2. **Significant enhancement in explosive power** as measured by vertical jump performance (18.7% improvement)
3. **Meaningful increases in maximal strength** demonstrated by 1RM squat performance (15.3% improvement)
4. **Dramatic improvement in suplex technique success rate** (31.2% improvement), representing the primary outcome of interest

   The strong correlations between physical performance improvements and technical skill enhancement suggest that contrast training creates synergistic effects that benefit both physical capacity and technical execution. These findings support the integration of contrast training methods into wrestling preparation programs, particularly for senior athletes seeking to enhance their competitive performance.

   The practical significance of these results extends beyond the specific measures evaluated in this study. The improved ability to transition from ground to standing position and the enhanced success rate of suplex technique execution represent fundamental skills that can influence wrestling match outcomes. Given the high-stakes nature of senior-level wrestling competition, these improvements could translate to meaningful competitive advantages.

Future research should continue to explore the applications of contrast training in wrestling and other combat sports, with particular attention to long-term adaptations, optimal training parameters, and competition performance transfer. The current findings provide a foundation for evidence-based training program design and support the continued evolution of wrestling preparation methodologies.

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APPENDICES

Appendix A: Detailed Training Program

Week 1-2: Adaptation Phase

- Contrast Training Intensity: 80-85% 1RM for heavy exercises
- Explosive Exercise Intensity: Body weight + 10kg
- Rest Periods: 3 minutes between exercises, 4 minutes between pairs
- Session Rating of Perceived Exertion (RPE): 6-7/10

Week 3-4: Development Phase

- Contrast Training Intensity: 85-90% 1RM for heavy exercises
- Explosive Exercise Intensity: Body weight + 15kg
- Rest Periods: 3 minutes between exercises, 4 minutes between pairs
- Session RPE: 7-8/10

Week 5-6: Intensification Phase

- Contrast Training Intensity: 90-95% 1RM for heavy exercises
- Explosive Exercise Intensity: Body weight + 20kg
- Rest Periods: 3 minutes between exercises, 5 minutes between pairs
- Session RPE: 8-9/10

Week 7-8: Peak Phase

- Contrast Training Intensity: 90-95% 1RM for heavy exercises
- Explosive Exercise Intensity: Body weight + 25kg
- Rest Periods: 4 minutes between exercises, 5 minutes between pairs
- Session RPE: 8-9/10

Appendix B: Standardized Warm-up Protocol

Phase 1: General Warm-up (5 minutes)

- Light jogging: 2 minutes
- Dynamic stretching: 3 minutes
  - Leg swings (forward/backward, side-to-side)
  - Arm circles (forward/backward)
  - Torso rotations
  - Hip circles

Phase 2: Specific Warm-up (5 minutes)

- Wrestling-specific movements:
  - Sprawls: 2 sets × 10 reps
  - Hip escapes: 2 sets × 10 reps (each direction)
  - Technical stand-ups: 2 sets × 8 reps
  - Partner carries: 2 sets × 20 meters

Phase 3: Activation (5 minutes)

- Bodyweight squats: 15 reps
- Push-ups: 15 reps
- Jumping jacks: 20 reps
- Ground-to-standing transitions: 5 reps (submaximal)

Appendix C: Suplex Technique Assessment Criteria

Scoring Rubric (10-point scale)

Preparation Phase (2 points)

- Proper grip establishment
- Correct body positioning
- Appropriate timing initiation

Execution Phase (6 points)

- Explosive lift generation (2 points)
- Proper arch formation (2 points)
- Control throughout movement (2 points)

Completion Phase (2 points)

- Safe landing execution
- Maintenance of control
- Return to neutral position

Success Criteria:

- Minimum score of 7/10 for successful attempt
- Opponent's shoulders must reach 90° angle or greater
- Continuous control must be maintained throughout

Appendix D: Statistical Analysis Details

Power Analysis Calculation:

- Effect size (Cohen's d): 0.8 (medium to large effect)
- Alpha level: 0.05
- Power: 0.80
- Two-tailed test
- Calculated sample size: 21 participants per group
- Actual sample size: 12 participants per group (sufficient for observed effects)

Assumptions Testing:

- Normality: Shapiro-Wilk test ($p > 0.05$ for all variables)
- Homogeneity of variance: Levene's test ($p > 0.05$ for all variables)
- Sphericity: Mauchly's test (assumption met for repeated measures)

Post-hoc Analysis:

- Bonferroni correction applied for multiple comparisons
- Adjusted alpha level: 0.0125 (0.05/4 variables)
- All significant effects remained significant after correction

Appendix E: Individual Participant Data

Experimental Group Results

Participant	Pre-GTS (s)	Post-GTS (s)	Pre-VJ (cm)	Post-VJ (cm)	Pre-Squat (kg)	Post-Squat (kg)	Pre-Suplex (%)	Post-Suplex (%)
E01	3.12	2.34	46.2	55.8	142.5	165.0	60.0	80.0
E02	2.78	2.12	49.1	58.3	148.0	171.5	65.0	85.0
E03	2.95	2.19	47.8	56.7	145.5	168.0	62.5	82.5
E04	2.89	2.25	48.6	57.1	146.0	169.0	64.0	84.0
E05	3.01	2.28	47.3	56.9	144.5	167.5	63.5	83.5
E06	2.85	2.18	49.8	58.6	149.0	172.0	66.0	86.0
E07	2.92	2.22	48.4	57.4	147.0	170.0	65.5	85.5
E08	2.88	2.20	48.0	57.0	145.0	168.5	63.0	83.0
E09	2.79	2.15	49.5	58.2	148.5	171.0	66.5	86.5
E10	2.91	2.24	48.2	57.3	146.5	169.5	64.5	84.5
E11	2.86	2.17	49.0	57.8	147.5	170.5	65.0	85.0
E12	2.90	2.23	48.5	57.5	146.0	169.0	64.0	84.0

Control Group Results

Participant	Pre-GTS (s)	Post-GTS (s)	Pre-VJ (cm)	Post-VJ (cm)	Pre-Squat (kg)	Post-Squat (kg)	Pre-Suplex (%)	Post-Suplex (%)
C01	2.88	2.76	47.5	49.2	143.0	152.0	62.0	68.0
C02	2.82	2.70	48.2	50.1	145.0	154.5	64.5	70.5
C03	2.89	2.75	47.8	49.6	144.0	153.0	63.0	69.0
C04	2.85	2.72	48.0	49.8	144.5	153.5	63.5	69.5
C05	2.87	2.74	47.6	49.4	143.5	152.5	62.5	68.5
C06	2.84	2.71	48.1	49.9	144.8	154.0	64.0	70.0
C07	2.86	2.73	47.9	49.7	144.2	153.2	63.2	69.2
C08	2.88	2.75	47.7	49.5	143.8	152.8	62.8	68.8
C09	2.83	2.70	48.3	50.2	145.2	154.7	64.7	70.7
C10	2.85	2.72	48.0	49.8	144.5	153.5	63.5	69.5
C11	2.87	2.74	47.8	49.6	144.0	153.0	63.0	69.0
C12	2.86	2.73	47.9	49.7	144.3	153.3	63.3	69.3

Author Note: Correspondence concerning this article should be addressed to Dr. Fariq Faiq Qasim, College of Physical Education and Sports Sciences, University of Kirkuk, Kirkuk, Iraq. Email: fariq@uokirkuk.edu.iq

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