Journal of Education and Educational Research
ISSN: 2957-9465 | Vol. 13, No. 2, 2025

Experimental Study on the Influence of Enhanced Training on Lower Limb Strength of Aviation Safety and Security Major Students

Shangjin Feng *

Crew Academy, Shanghai Civil Aviation College, Shanghai, CO 200235, China
*** Corresponding author Email:** fengshangjin@shcac.edu.cn

Abstract: This study focuses on aviation safety and security major students. Utilizing methods such as literature review, expert interviews, questionnaire surveys, experimental methods, and mathematical statistics, the research investigates the impact of enhanced training on lower limb strength of aviation safety and security major students. The experimental results reveal that enhanced training significantly improves the performance of aviation safety and security major students in the 25-meter shuttle run, triple hop test, 30-second hexagonal barbell deadlift (90kg), and T-test, especially showing notable enhancements in the 25-meter shuttle run, triple hop test, and T-test performance.

Keywords: Aviation Safety and Security; Enhanced Training; Lower Limb Strength.

1. Introduction

With the rapid development of the aviation industry, aviation security personnel have increasingly garnered attention and importance as a vital component of aviation safety. As future aviation security personnel, students majoring in Aviation Security must possess not only a solid understanding of aviation knowledge, laws and regulations, and criminal psychology but also excellent physical and psychological qualities. In addition to mastering necessary aviation knowledge, legal regulations, and criminal psychology, they must also possess strong combat skills, good negotiation techniques, and undergo various skill trainings such as anti-hijacking and anti-bombing operations. Furthermore, students in the Aviation Security major must meet the initial training standards for aviation security personnel in various physical fitness tests.

In physical fitness training, within the prescribed exercise mechanical models, muscles and tendons are elongated, and energy is stored in muscles and tendons under the state of force application. When a certain critical point is reached, the energy is released instantly, resulting in deformation and potential energy doing work. According to the NSCA's Introduction to Physical Fitness Training textbook, training movements that allow muscles to exert maximum energy in a short period of time are referred to as enhanced training [1]. Enhanced training can improve and enhance the trainee's strength, with the most noticeable improvements seen in explosive power and maximum strength. However, it does not involve changes in muscle fiber thickness [2]. Additionally, it has a positive effect on the trainee's rapid strength, speed, and frequency but has a reverse effect on muscle endurance. Enhanced training combines speed and explosiveness, making it one of the common training methods in physical fitness training [3]. Through detailed research methods, it is understood how enhanced training will produce corresponding effects on the trainees [4]. By applying this training method to the physical fitness training of students majoring in Aviation Security and comparing the data before and after the experiment, the changes and gaps in the experimental indicators of the students can be analyzed, making the training more standardized, scientific, and targeted, thus scientifically and efficiently improving the lower limb strength of students majoring in Aviation Security.

2. Research Methods

2.1. Literature Review Method

Multiple searches were conducted on platforms such as CNKI and BaiLink using keywords such as "enhanced training," "aviation safety and security major," and "lower limb strength." Additionally, relevant books and literature on sports training were consulted to provide theoretical foundations and references for developing related intervention programs and testing indicators.

2.2. Expert Interview Method

Experts in coaching and sports training were interviewed based on the research objectives and needs, obtaining relevant information to assist in the design of research schemes and the conduct of experiments.

2.3. Questionnaire Survey Method

Questionnaires were distributed to experts in physical training and sports training to determine training sites, methods, and loads, thereby formulating training plans for aviation safety and security major students.

2.4. Experimental Method

2.4.1. Experimental Subjects

The experiment involved 40 students majoring in aviation safety and security at Shanghai Civil Aviation College, who were randomly assigned to two groups: experimental group and control group.

2.4.2. Experimental Venue

The experiment took place at the track and field stadium and physical training room of Shanghai Civil Aviation College.

2.4.3. Training Plan

Both groups of aviation safety and security major students

underwent an 8-week strength intervention training at the physical training room of Shanghai Civil Aviation College, with two training sessions per week, each lasting 90 minutes.

Table 1. Training Program

Group	Training Content	Frequency (Cycle)	Sets/Intervals	Repetitions/Intervals
Experimental Group	**Standing Long Jump**	1,3,5	4 sets / 1.5-2min	15-20/20s
	Explosive Standing Long Jump	1,3,5	4 sets / 1.5-2min	15-20/20s
	Box Jumps	1,3,5	4 sets / 1.5-2min	15-20/20s
	Alternating Leg Push	1,3,5	4 sets / 1.5-2min	15-20/20s
Control Group	**Barbell Deadlift 10kg**	1,3,5	4 sets / 2min	10/30s
	Barbell Deadlift 15kg	1,3,5	6 sets / 2min	10/30s
	Barbell Deadlift 20kg	1,3,5	6 sets / 2min	10/30s
	Barbell Deadlift 25kg	1,3,5	4 sets / 2min	10/30s
Experimental Group	**Double Leg Squat Jumps**	1,3,5	4 sets / 1.5-2min	15-20/20s
	Single Leg Alternating Jumps	1,3,5	4 sets / 1.5-2min	15-20/20s
	Box Jumps Down	1,3,5	4 sets / 1.5-2min	15-20/20s
	Leg Press (Both Sides)	1,3,5	4 sets / 1.5-2min	15-20/20s
Control Group	**Barbell Squat 15kg**	1,3,5	6 sets / 2min	15/30s
	Barbell Squat 20kg	1,3,5	6 sets / 2min	15/30s
	Barbell Squat 25kg	1,3,5	6 sets / 2min	15/30s
	Barbell Squat 30kg	1,3,5	4 sets / 2min	15/30s
Experimental Group	**Zigzag Jumps**	1,3,5	4 sets / 1.5-2min	15-20/20s
	Depth Jumps	1,3,5	4 sets / 1.5-2min	15-20/20s
	Depth Jump to Box	1,3,5	4 sets / 1.5-2min	15-20/20s
	Single Leg Depth Jump	1,3,5	4 sets / 1.5-2min	15-20/20s
Control Group	**Barbell Squat 10kg**	1,3,5	4 sets / 2min	10/30s
	Barbell Squat 15kg	1,3,5	6 sets / 2min	8/30s
	Barbell Squat 20kg	1,3,5	6 sets / 2min	8/30s
	Barbell Squat 25kg	1,3,5	4 sets / 2min	8/30s

2.4.4. Testing Indicators

Testing indicators include the 25-meter shuttle run, triple hop test, 30-second hexagonal barbell deadlift (90kg), and T-test.

2.5. Statistical Methods

Relevant data, including pre-test and post-test records, are standardized and imported into SPSS 22.0. The mean, standard deviation, T-value, and P-value of the data required for the study are obtained and subjected to statistical analysis. Independent sample tests are conducted on the experimentally obtained values.

3. Research Results and Analysis

3.1. Analysis of Results of Plyometric Training on 25-meter Return Run Performance

The results of the 25-meter return run of the experimental group and the control group were tested before the experiment. The experimental data was introduced into spss22.0 for analysis to obtain independent sample T test data.

Table 2. Analysis of the 25-meter return run results of the two groups before the experiment

Test indicators	Experimental group	Control group	T value	P value
25-meter return run	35.34±1.38	35.64±1.26	-0.724	0.474

Note: "*" means there is a statistical difference p<0.05, "**" means there is a significant difference p<0.01

The experimental results showed that after comparing the pretest data of the experimental group and the control group, the two groups were comparable (P>0.05).

Table 3. Analysis of the 25-meter return run results of the two groups after the experiment

Test indicators	Experimental group	Control group	T value	P value
25-meter return run	34.45±0.55	35.28±0.79	-3.802	0.006**

Note: "*" means there is a statistical difference p<0.05, "**" means there is a significant difference p<0.01

The experimental results show that: after comparing the post-test data between the experimental group and the control group, there is a significant difference in the 25-meter return performance (P<0.01).

The 25-meter return run is a required physical fitness test for aviation safety officers. It tests the short-distance explosive power of the legs, short-distance acceleration, muscle endurance, and sensitivity. It can be seen from the data that plyometric training can effectively improve students' performance in the 25-meter return run. Although the 25-meter return run performance of the students in the control group improved, the improvement was limited. It can be seen that traditional training has little impact on the students' 25-meter return run performance.

3.2. Analysis of Results of Plyometric Training on Third-Level Frog Jump Performance

The experimental group and the control group took the pre-test three-level frog jumping scores. The experimental data were introduced into spss22.0 for analysis to obtain the independent sample T test data.

Table 4. Analysis of the three-level frog jumping results of the two groups before the experiment

Test indicators	Experimental group	Control group	T value	P value
three-level frog jumping	6.81±0.59	6.43±0.84	1.668	0.100

Note: "*" means there is a statistical difference p<0.05, "**" means there is a significant difference p<0.01

The experimental results showed that after comparing the pretest data of the experimental group and the control group, the two groups were comparable (P>0.05).

Table 5. Analysis of the three-level frog jumping scores of the two groups after the experiment

Test indicators	Experimental group	Control group	T value	P value
three-level frog jumping	7.58±0.27	6.97±0.55	4.364	0.000**

Note: "*" means there is a statistical difference p<0.05, "**" means there is a significant difference p<0.01

The experimental results show that after comparing the pre- and post-test data between the experimental group and the control group, there is a significant difference in the level 3 frog jumping scores (P<0.01).

The third-level frog jump tests the explosive power of the legs, jumping ability and body coordination. It can be seen from the data that plyometric training can effectively improve the performance of the third-level frog jump. Plyometric training significantly improved the explosive power and jumping ability of the legs of the students in the experimental group. After the experiment, there was a significant difference in the third-level frog jump performance between the students in the experimental group and the control group.

3.3. Analysis of Results of Plyometric Training on 30-Second Hexagonal Barbell Deadlift (90kg)

The 30-second hexagonal barbell deadlift (90kg) performance of the experimental group and the control group was measured before and after the experiment. The experimental data was introduced into spss22.0 for analysis to obtain independent sample T test data.

Table 6. Analysis of the results of the hexagonal barbell deadlift (90kg) in the 30 seconds before the two groups of experiments

Test indicators	Experimental group	Control group	T value	P value
Hex Barbell Deadlift	5.95±4.62	5.25±4.17	0.502	0.619

Note: "*" means there is a statistical difference p<0.05, "**" means there is a significant difference p<0.01

The experimental results showed that after comparing the pretest data of the experimental group and the control group, the two groups were comparable (P>0.05).

Table 7. Analysis of 30-second hexagonal barbell deadlift (90kg) results after two groups of experiments

Test indicators	Experimental group	Control group	T value	P value
Hex Barbell Deadlift	10.4±4.72	7.05±3.67	2.50	0.017*

Note: "*" means there is a statistical difference p<0.05, "**" means there is a significant difference p<0.01

The experimental results show that after comparing the pre- and post-test data between the experimental group and the control group, there is a statistical difference in the 30-second hexagonal barbell deadlift (90kg) results (P<0.05). The 30-second hexagonal barbell deadlift (90kg) mainly tests the strength of the lower limb muscles such as the quadriceps, hamstrings and gluteus maximus, and is completed within 30 seconds, which further tests the short-term explosive power of each muscle group. It can also be seen from the data that plyometric training after the experiment can effectively improve the 30-second hexagonal barbell deadlift performance.

3.4. Analysis of Results of Plyometric Training on T-shaped Running Performance

The T-shaped running scores of the experimental group and the control group were measured before and after the experiment, and the experimental data was introduced into spss22.0 for analysis to obtain independent sample T-test data.

Table 8. Analysis of T-shaped running results of the two groups before the experiment

Test indicators	Experimental group	Control group	T value	P value
T-shaped run	25.70±2.23	25.28±0.88	0.792	0.433

Note: "*" means there is a statistical difference p<0.05, "**" means there is a significant difference p<0.01

The experimental results showed that after comparing the pretest data of the experimental group and the control group, the two groups were comparable (P>0.05).

Table 9. Analysis of the T-shaped running results of the two groups after the experiment

Test indicators	Experimental group	Control group	T value	P value
T-shaped run	24.53±0.58	25.07±0.58	-2.939	0.006**

Note: "*" means there is a statistical difference p<0.05, "**" means there is a significant difference p<0.01

The experimental results show that after comparing the pre- and post-test data between the experimental group and the control group, there is a significant difference in T-shaped running performance (P<0.01).

shaped running is a test of students' agile movement ability, ability to accelerate and decelerate, and the strength of small muscle groups in the legs. Experimental data shows that plyometric training can effectively improve T-shaped running performance.

4. Conclusion

As an effective physical training method, plyometric training can significantly improve the performance of airborne maintenance majors in the 100-meter run, 25-meter return run, three-level frog jump, 30-second hexagonal barbell deadlift (90 kg), T-shaped run, etc. Performance in physical fitness events. In addition, plyometric training can also significantly improve their lower limb strength levels, especially lower limb explosiveness and jumping ability. In contrast, although traditional strength training improved various lower limb strength indicators of airborne maintenance majors, it did not show significant differences in many indicators. Therefore, plyometric training, as a more comprehensive and efficient training method, has a better effect on improving the physical fitness and sports performance of airborne maintenance majors. Especially in projects that require quick reactions and explosive power, plyometric training can effectively improve students' physical fitness levels and lay a solid foundation for their future career development. Therefore, the use of plyometric training should be fully considered in the training program for students majoring in air maintenance to improve their overall physical fitness level and sports performance, so as to better adapt to future work needs.

References

[1] Shanghai Sports Vocational College, translated. Introduction to NSCA Physical Training [M]. Published by Shanghai Sanlian Bookstore, 2007.

[2] Yuri Verohoshanski. Relationships between the muscle fibre characteristics, sprinting and jumping of sprinters[J]. Biology of Sport.

[3] Dong Wenyang. Effect of plyometric training on the specific physical fitness of young male long jump athletes [D]. Jilin University, 2015.

[4] Zhong Xinsheng, Yao Lu, Zhang Dong. Effect of super-isometric training on the explosive power of lower limbs of young athletes [J]. Journal of Minnan Normal University (Natural Science Edition), 2015, 28(03):94-99.