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**Original Research Article**

# Effect of Battle Rope and Jump Rope Training Combined with Ladder Drills on Cardio Respiratory Endurance of College Men Students

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## Abstract

***Objectives:*** This study aimed to investigate the effect of battle rope and jump rope training combined with ladder drills on cardio respiratory endurance of college men students. ***Methods:*** The experimental study enrolled 45 college men students from Kumaraguru Institute of Agriculture, Erode, Tamil Nadu, who were selected to carry out the research. The subjects who met the inclusion criteria were selected using convenience sampling and randomly divided into two intervention groups. The test items used to collect the cardio respiratory endurance tested by Cooper 1.5-mile run test and for completed by the participants before the training intervention. The stipulated training was provided to the participants for the period of 50-minute sessions for the three alternative days in a week. ***Statistical Procedure****:* To process the results of the study, analysis of the data was done with the IBM SPSS Statistics 22 software. The statistics obtained were provided by paired sample t-test. The improvement percentage was assessed by using the formula of "%Δ = (x post-test – x pre-test) / pre-test * 100." The level of confidence was fixed at 95% and values below $p<0.05$ were considered significant. ***Results****:* The paired sample t-test showed a significant ($p<0.05$) improvement in selected dependent variables over the 12 weeks of stipulated training. ***Conclusion:*** The results indicate considerable significant improvement on selected variable was observed. The findings indicate that both the training regimes led to significant improvement on the selected cardio respiratory endurance namely, Cooper test observation. The jump rope training combined with ladder drills has produced a superior effect compared to the battle rope training combined with ladder drills.

**Keywords:** Battle Rope, Jump Rope, Ladder Drills, Cardio Respiratory Endurance, Paired sample t-test.



## INTRODUCTION

Physical training involves subjecting the organism to a training load or work stress that is intense, prolonged, and frequent enough to have a discernible or quantifiable training effect that is, to enhance the functions for which training is being done. Maniazhagu, Malar, and Manogri (2019). In modern civilization, resistance training methods have evolved significantly and there are several forms of training absence of traditional weights: bodyweight exercises and resistance bands, battle rope training for overall muscular strength and development. Resistance equipment, such as resistance ropes is essential for enhancing athletes' physical strength and motor function. These devices increase a person's power, velocity, and other athletic abilities by utilizing their body's mass and force, Pullen, J. L. Oliver, R. S. Lloyd, and C. J. Knight (2020). Battle rope exercises have acute impact on performance related parameters for instance shooting accuracy and pass speed thus can be effective during training session meant to improve technical ability under W. H. Chen (2018).Jumping rope is one of the top calorie burners on the planet, ranking up there in calories burned per minute with a vigorous basketball game, a six-minute mile run and 20 miles per hour bike ride. Jumping rope needs a rope and about four feet of horizontal space and eight fee of vertical space. Jumping rope can additionally use as a high intensity interval training workout. Stewart and J. Warner (2012). Because of the quick rebounding, jumping rope primarily works the foot muscles and joints. It may be regarded as a form of plyometric training to increase power and stiffness, two essential components of endurance-running performance. Pinillos (2019). The ladder is a form of a physical training using stairs to train the agility of the legs and to harmonize movements in a balanced manner. The agility ladder is

a training tool for coordination, speed, and agility. In this agility ladder, athletes can move their feet quickly in the right motion Rosdiana and Sidik(2023). Cardiorespiratory endurance is the ability of the heart, lungs, and blood vessels to supply oxygen to working muscles during sustained, moderate-to-high intensity physical activity. The study will involve ladder drills on cardio respiratory endurance combined with battle rope and jump rope training.

## MATERIAL AND METHOD

For achieve the purpose of 45 students has divided into two experimental and a control group. The two training interventions group has enforced for the 12-week experiment that included battle rope training, jump rope training and ladder drills and to prevent injuries, the students were subjected to three preparatory training sessions (initial stage). The first week of this phase included 4 sessions (Monday, Tuesday, Wednesday, and Thursday) that developed aerobic power and general fitness (drills without the external resistance). In the second week, the subjects underwent four training sessions (Monday, Tuesday, Wednesday, and Thursday) including general fitness, ladder and jump rope drills. The initial phase was finished, and the players took two days off. The tests were then conducted on a ground by the test volunteers. The athletes wore common running shoes made for practice. The tests began with a 25-minute warm-up that included three minutes of low-intensity running (30% of HRmax), two minutes of high-intensity running (60% of HRmax), three minutes of static stretching, seven minutes of general strength and explosive power drills (A and C skips, single-leg skips, ground bounces, jumps up with raising knees and feet), and three minutes of static stretching. The subjects then marched for one minute and ran two 10-meter sprints after completing the warm-up, the players were provided with detailed information on the research procedures**.** The tests involved by Cooper 1.5-mile run -walk test were taken.

The detailed training description and load dynamics of both the training groups have given below.

**Battle Rope Training**

Battle rope training typically uses ropes 12 to 15 m long, 3 to 5 cm in diameter and weighing 9 to 16 kg, with sets typically lasting 15 to 30 seconds including rest periods. The BR used in this study had a length of 15 m, a diameter of 4 cm, and a mass of 18 kg. The protocol for weeks 1 to 4 included 50 minutes of work-rest exercise (15 seconds on, 45 seconds rest) for a total of 30 sets. The protocol from weeks 5 to 8 included 50 minutes of exercise (20 seconds on, 40 seconds rest) with work-to-rest ratio 30 sets. The protocol from weeks 9 to 12 included 50 minutes of exercise with work rest ratio (25 seconds on, 35 seconds rest) for a total of 36 sets

**Data Analysis**

To process the results of the study, analysis of the data was done with the IBM SPSS Statistics 22 software. The statistics obtained were provided by paired sample t test. The improvement percentage were assessed by using the formula of "%Δ = (x post-test – x pre-test) / pre-test *100". The level of confidence was fixed 95% and values below $p<0.05$ were considered significant.

**Table 1: Effects of battle rope training combined with ladder drills and jump rope training combined with ladder drills on Cardio respiratory endurance parameter**

| Group | Test | Mean | SD | Mean Difference | DF | 't' ratio | p value |
|---|---|---|---|---|---|---|---|
| **BR-LD** | **Pre** | 1813.60 | 31.90 | 200.60 | 14 | 38.21* | 0.00 |
| | **Post** | 2014.20 | 27.53 | | | | |
| **JR-LD** | **Pre** | 1809.33 | 26.81 | 291.73 | 14 | 19.15* | 0.00 |
| | **Post** | 2101.06 | 51.41 | | | | |
| **CG** | **Pre** | 1811.06 | 20.48 | 1.2 | 14 | 1.79 | 0.09 |
| | **Post** | 1809.86 | 20.31 | | | | |
| 0.05 level of significance. *Significant ($p<0.01$), insignificant ($p>0.05$) | | | | | | | |

The pre- and post-test mean differences of experimental and control groups are displayed in Table. Battle rope training combined with ladder drills (BR-LD) had a mean and standard deviation of 1813.60+31.90 and 2014.20+27.53 before and after the test. The mean difference was 200.60. The computed t-test value ($t=38.21^*$, $p<0.01$) was significant. It demonstrates that the cardio-respiratory endurance has significantly improved as a result of battle rope training combined with ladder drills (BR-LD). Jump rope training combined with ladder drills (JR-LD) had a mean and standard deviation of 1809.33+26.81 and 2101.06+51.41 before and after the test. The mean difference was 291.73. The computed t-test value ($t=19.15^*$, $p<0.01$) was significant. It demonstrates that the cardio-respiratory endurance has significantly improved as a result of jump rope training combined with ladder drills (JR-LD). The control group (CG) had a mean and standard deviation of 1811.06+20.48 and 1809.86+20.31 before and after the test. The mean difference was 1.2. The computed t-test value ($t=1.79$, $p>0.05$) was insignificant. It demonstrates that the control group has not seen an improvement in cardio respiratory endurance. According to the above table, the 12 weeks of battle rope training combined with ladder drills (BR-LD) and jump rope training combined with ladder drills (JR-LD) have significantly improved

cardio respiratory endurance. The control group did not show any improvement.

Analysis of adjusted post-test mean values of experimental and control groups on cardio respiratory endurance.

Taking pre-test scores as a covariate, one-way analysis of covariance (ANCOVA) was used to examine the adjusted post-test mean differences on cardio respiratory endurance of battle rope training combined with ladder drills (BR-LD), jump rope training combined with ladder drills (JR-LD) and control group. This allowed for the testing of accuracy of the post-test mean differences among the groups. The same information is shown in table 1.

**Table 2(a): Adjusted post-test means differences of experimental and control groups on cardio respiratory endurance (Scores in meters)**

| Adjusted Post Test Means | | | SV | SS | Df | MS | 'F'-ratio | p Value |
|---|---|---|---|---|---|---|---|---|
| BR-LD | JR-LD | CG | B | 672113.10 | 2 | 336056.55 | 296.74* | 0.00 |
| 2013.11 | 2102.02 | 1809.99 | W | 46431.694 | 41 | 1132.48 | | |
| 0.05 level of significance. *Significant (p<0.01), insignificant (p>0.05) | | | | | | | | |

The adjusted post-test mean values of experimental and control groups were displayed in table 2(a) The adjusted post-test mean values of battle rope training combined with ladder drills (BR-LD) was 2013.11, jump rope training combined with ladder drills (JR-LD) was 2102.02 and control group was 1809.99. The computed "F" ratio (F=296.74*, p<0.01) was significant. It shows that there was a significant difference among the groups on cardio respiratory endurance. Additionally, to determine which training group showed the greatest improvement in cardio-respiratory endurance, the Scheffe's Post hoc test was employed. The same discussed in the table 2(b).

**Table 2(b): Scheffe's post hoc test on cardio respiratory endurance of experimental and control groups (Scores in meters)**

| BR-LD | JR-LD | CG | Mean Differences | P value |
|---|---|---|---|---|
| 2013.11 | 2102.02 | ----- | 88.92* | 0.00 |
| 2013.11 | ----- | 1809.99 | 203.11* | 0.00 |
| ----- | 2102.02 | 1809.99 | 292.03* | 0.00 |
| 0.05 level of significance. *Significant (p<0.01), insignificant (p>0.05) | | | | |

Pairwise comparison of BR-LD and JR-LD: The adjusted post-test mean differences of battle rope training combined with ladder drills and jump rope training combined with ladder drills was 88.92. It was significant (p<0.01). It shows that both the groups have produced significantly different effect on cardio respiratory endurance. The pairwise comparison shows that, the jump rope training combined with ladder drills have produced greater effect on cardio respiratory endurance. Pairwise comparison of BR-LD and CG: The adjusted post-test mean differences of battle rope training combined with ladder drills and a control group was 203.11. It was significant (p<0.01). The pairwise comparison shows that, the battle rope training combined with ladder drills have produced greater effect on cardio respiratory endurance. Pairwise comparison of JR-LD and CG: The adjusted post-test mean differences of jump rope training combined with ladder drills and control group was 292.03. It was significant (p<0.01). The pairwise comparison shows that, the jump rope training combined with ladder drills have produced greater effect on cardio respiratory endurance.

## DISCUSSION

The pre and posttest means of the cardio respiratory endurance test values were found to be statistically different based on the measurement over time, as indicated by the results in Table 1. According to the study, the performance of aerobic capacity was greatly improved by twelve weeks of battle rope training combined with ladder drills and jump rope t raining combined with ladder drills. Research has demonstrated whether eight weeks of combat rope training improves many aspects of physical fitness. After training, the combat rope group outperformed the SR group in terms of upper-body AnP (mean power and fatigue index). As a result, BR training helps collegiate basketball players become more physically strong and enhance their shooting accuracy W. H. Chen (2018). The literature indicates that he findings of this study showed significant improvements in the voluntary capacity and body mass index of the experimental groups. Vital capacity was higher in the music jump rope exercise group than the stationary cycle exercise group, and body mass index was lower in the music jump rope exercise group than the stationary cycle exercise group. Yakout, A. Larion, and C. Popa (2017). According Alibrahim and A. K. Hassan (2024) effects of battle rope and elastic training on physiological and physical indicators in athletes participating in individual sports, these training methods are beneficial for athletes. Future studies should look into how this type of training affects biochemical indicators

like hemoglobin and lactic acid levels, as these measurements are essential for understanding how the body reacts to intense training and its capacity for recovery. D. Maniazhagu, S. Malar, and M. Manogari (2019) found that the impact of circuit and battle rope training on schoolgirls' speed revealed that both training methods enhanced the speed's characteristics. In the two training groups, the improvement was comparable. Research indicates that including a rope jump training program into school physical education classes has improved students' weight, fat ratio, speed, leg strength, and VO2 max after ten weeks of training. The development of these parameters in the children at this age was expedited and enhanced by the rope-jump training program, it can be said N. Eler and H. Acar, (2018). The research found that the integrative neuromuscular training (strength training, coordination exercises, jump rope training etc.) combined with yoga and stretching exercises have improved the ability of speed in primary school children. Malar and D. Maniazhagu (2019) Overall, when comparing the results of jump rope training with ladder drills, it was found that the BR-LD and JR-LD: The adjusted post-test mean differences of battle rope training combined with ladder drills and jump rope training combined with ladder drills was 88.92. It was significant ($p<0.01$). It shows that both the groups have produced significantly different effect on cardio respiratory endurance. The conceptual research findings include two indicators: the ladder drill model and the pairing jump rope athletic training model both enhance the athletic ability of children, but descriptively, there is a difference in the enhancement of children's athletic ability between the two models of athletic training in schoolchildren. When it comes to children's athletic abilities, the ladder drill model of athletic training is superior to the pair jump rope model. Rohman, A. Cholid, R. Septiria, and A. L. Hakim (2019) According to the study, the performance of power ability was greatly improved by twelve weeks of battle rope training combined with ladder drills and jump rope training combined with ladder drills. The results of a study on the impact of battle rope exercises on college students' power and jumping abilities revealed that for female handball players looking to increase their power and leaping ability, the Battle rope is a very useful training aid. Research on the impact of jump rope training on the physical fitness of female students aged 9 to 10 has demonstrated that jump rope training improves female students' physical fitness M. Sohrabi Jahromi and M. Gholam (2015). According to the results of effects of jump rope training on explosive power in badminton players have found that the athletes' lower limb explosive power and speed can be significantly increased by incorporating jump rope training into their physical badminton training J. Tang (2020). There has been a stronger impact on upper body muscular endurance after six weeks of circuit and battle rope exercise. Battle rope training was proven to have a greater impact than circuit training. Maniazhagu, Thiyagachanthan, K. S. Sridhar, M. Kalidasan, S. Malar, and M. Manogari (2021). Over all BR-LD and JR-LD: The adjusted post-test mean differences of battle rope training combined with ladder drills and jump rope training combined with ladder drills was 88.92. It was significant ($p<0.01$). It shows that both the groups have produced significantly different effect on cardio respiratory endurance.

## CONCLUSION

This study aimed to assess the effect of battle rope and jump rope training combined with ladder drills on cardio respiratory endurance in college male students. The results indicate considerable significant improvement on selected variable. The findings indicate that both the training regimes led to significant improvement on the cardio respiratory endurance, namely cooper test. The jump rope training combined with ladder drills has produced significant improvement on fitness enhancing components than the control group. The improvement in the jump rope training combined with ladder drills occurred owing to the fastest foot movements, coordination, and leg explosive movements. In contrast, the battle rope training combined with ladder drills correspondingly demonstrated an improvement, but to a smaller extent.

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