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**The Effect of Repeated Sprint Ability Training on the Speed Endurance of Backs in Bandung City Rugby Sevens**

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**Abstract**

**Studi Purpose:** This study aims to determine the effect of Repeated Sprint Ability (RSA) training on the speed endurance of backs in the Bandung City rugby sevens team.

**Material and Methods:** The method used was a quasi-experimental study with a randomized pretest–posttest control group design. The sample consisted of 20 athletes divided into an experimental group (10 athletes) and a control group (10 athletes). The experimental group underwent an RSA training program for four weeks, with three sessions per week, while the control group followed the team's regular training schedule. The measurement instrument used was the Repeated Sprint Ability Test, specifically the 6 × 40 m protocol, to obtain speed endurance indicators (mean sprint time). Data analysis included descriptive statistics, the Shapiro–Wilk normality test, paired t-tests, and independent t-tests.

**Result:** The results showed that RSA training had a significant effect on improving speed endurance in the experimental group. However, the difference test indicated no significant difference between the experimental and control groups in terms of speed endurance ($p=.348$). In contrast, a significant difference was found in the Fatigue Index (FI) between groups ($p=.023$), indicating that RSA training was more effective in reducing fatigue and improving the ability to maintain sprint performance under repeated high-intensity conditions.

**Conclusion:** These findings suggest that RSA training is more effective in enhancing fatigue tolerance and maintaining the quality of repeated sprints, as required in rugby sevens. Thus, RSA training is recommended to be systematically integrated into the physical periodization program of back athletes to improve performance readiness in the competition phase.

**Keywords:** repeated sprint ability; speed endurance; fatigue index; rugby seven; backs position.

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## Introduction

Rugby sevens is a team sport characterized by fast-paced, intermittent play that demands the ability to perform high-intensity activities repeatedly (Lee et al., 2022). Some common movements in rugby include maximum sprints, rapid acceleration, changes of direction, and transitions from attack to defense with relatively short recovery times or vice versa (Clarke et al., 2017). There are several physical components required in this sport, especially for backs who must be able to run from front to back or vice versa quickly and repeatedly in a single match (Bicudo et al., 2024; Peeters et al., 2019). In the context of performance requirements, the physical condition component that most determines a player's success, especially in the backs position, is speed endurance (Clarke et al., 2017). This is because rugby backs are more frequently involved in open play situations, where they exploit space and rapid acceleration over short but repeated durations (Couderc et al., 2023), making speed endurance essential for rugby athletes and supporting peak performance.

A decline in sprint performance during the mid-to-late stages of competition has been reported in rugby sevens, particularly under conditions of accumulated fatigue and high match intensity. This reduction in sprinting quality is characterized by a decreased ability to reach the try line, often resulting in players being forced to pass rather than complete scoring opportunities. Consequently, backs may lose their advantage in open play situations, fail to exploit available space, and experience delays in defensive transitions, ultimately affecting overall game effectiveness and match outcomes (Peeters et al., 2019). From the explanations provided, it can be emphasized that rugby sevens athletes need to have good speed endurance, which can be achieved through training that supports the improvement of this component. Therefore, physical conditioning training programs must be directed towards training that is specific to the needs and adapted to the demands of the game so that the resulting adaptation is more effective and measurable (Doyle et al., 2020).

In the context of Rugby Sevens, the Fatigue Index is directly related to speed endurance quality because the nature of the game requires players to maintain maximum speed during
29 short recovery periods and metabolic stress accumulation (Wang et al., 2025). Physiologically, an increase in FI is influenced by limitations in phosphocreatine resynthesis, the accumulation of glycolytic metabolites, and disturbances in muscle ion balance, which contribute to a decrease in force production capacity and speed (Ulupınar et al., 2024). Furthermore, (Wang et al., 2025) explain that the ability to minimize the decline in repeated sprint performance reflects the integration of anaerobic capacity and aerobic system support in maintaining work output.

There are many types of exercises that can be used to improve speed endurance, including Repeated Sprint Ability (RSA) training, which is designed through repeated maximum sprints with limited recovery intervals and is considered effective in increasing phosphocreatine resynthesis capacity and optimizing neuromuscular efficiency. In addition, this exercise contributes to increased tolerance to metabolite accumulation and improved recovery ability between sprints, enabling athletes to maintain consistent speed output in each repetition (Shaun et al., 2024). However, in reality, this exercise has not been widely used by coaches to address speed endurance issues. In fact, based on research conducted by several previous researchers, it has been reported that repeated sprint training effectively improves repeated speed performance in high-intensity team (Glaise et al., 2022). Furthermore, research by (Pramkratok et al., 2022) shows that a Repeated Sprint Training (RST) program conducted on Rugby Seven players can improve Speed Endurance and Fatigue Index abilities as well as related aerobic and physiological performance through metabolic and cardiovascular adaptations after six weeks of repeated sprint training.

The novelty of this study lies not only in its position-specific focus on backs players, but also in the integrated use of Speed Endurance and Fatigue Index as complementary performance indicators to evaluate repeated sprint capacity under sport-specific fatigue conditions in rugby sevens. While previous studies have generally examined the effects of repeated sprint training on overall team-sport athletes, this study specifically links RSA training adaptations to the physiological and tactical demands of the backs position, which is characterized by frequent high-intensity sprints, rapid transitions, and limited recovery time.

Furthermore, this study proposes a structured RSA training model that incorporates multidirectional and game-representative sprint patterns, allowing for a more ecologically valid assessment of performance adaptations. By combining position-specific demands with dual performance indicators (SE and FI), this approach provides a more comprehensive framework for monitoring sprint consistency and fatigue tolerance, which are critical yet often under-integrated variables in existing rugby sevens training research.

## Materials and methods

### *Study participants*

The population in this study consisted of all male and female back position Rugby Seven athletes in Bandung who had been training for an average of almost two years. The sample consisted of 20 athletes. This sample was divided into two groups, namely the experimental group (10 athletes) and the control group (10 athletes).The relatively small sample size reflects the limited availability of athletes within a specific playing position at the regional level. Despite this limitation, total sampling was employed to ensure that the sample adequately represented the target population. Additionally, both male and female athletes were included to reflect the real composition of the team. However, no stratification by sex was performed, and therefore potential differences in physiological responses between sexes were not specifically controlled in this study.

### *Study organization*

The research method used in this study was an experiment with a randomized pretest-posttest control group design (Fraenkel, J.R., Wallen, N.E. and Hyun, 2011). The sampling technique used in this study was a census sampling approach, in which all available members of the population who met the inclusion criteria were included as research participants. This approach enabled the study to capture the overall performance characteristics of backs players within the specific context of regional rugby sevens training. Given the limited number of athletes in this position, this method is considered appropriate in applied sport science research to ensure representativeness of the target population (Etikan, 2016). The sample was divided using ABBA Random Assignment. This method divides subjects into two groups (A and B) evenly based on pretest results, by sorting participants from the highest to lowest pretest scores, then placing participants alternately in an ABBA pattern so that the initial abilities of both groups are relatively equal (Ho & Min, 2025).

### *Research instrument*

The research instrument used the Repeated Sprint Ability Test 6×40 m (20 m back and forth) with a 30-second rest interval to obtain the Speed Endurance indicator. The experimental group was given RSA training intervention for 4 weeks, while the control group underwent regular team training. The control group followed the team's regular training program, which consisted of general physical training and technical-tactical sessions typically used in rugby sevens training. The physical component included speed, agility, and coordination drills without systematic repetition, as well as strength training using body weight and basic resistance exercises. Technical-tactical training involved passing drills, game-based scenarios, and small-group games. Training frequency was two sessions per week, with each session lasting approximately 60 minutes. However, the control group did not perform structured repeated sprint training with a controlled work-to-rest ratio, as implemented in the RSA intervention program.

This research instrument was designed to assess the effect of Repeated Sprint Ability (RSA) training on the speed endurance of Rugby Sevens backs. In this measurement, there are two main indicators that can be generated through this instrument, namely Speed Endurance and Fatigue Index, which were selected for their validity in assessing sprint quality and the ability to maintain speed output.

Best sprint time (BST) is used to measure an athlete's maximum sprint speed. The test is conducted using a 6×40 meter sprint protocol with a 30-second recovery time between sprints, on a standard field surface. Athletes warm up for 15 minutes before the measurement to ensure physiological readiness and reduce the risk of injury. The fastest time from the 6 sprint trials is recorded and recorded in seconds. BST represents an individual's maximum sprint capacity and is the basis for calculating sprint performance consistency (Asimakidis et al., 2025).

Mean sprint time (MST) is used to assess the consistency of repeated sprint performance. MST is obtained from the average time of the sixth sprint in the same RSA protocol as the BST measurement. This indicator reflects an athlete's ability to maintain repeated sprint output, which is a key aspect of the intermittent and high-intensity nature of Rugby Sevens competition (Asimakidis et al., 2025).

The fatigue index is used to assess an athlete's ability to maintain sprint performance under conditions of fatigue. A lower FI value indicates a better ability to maintain repeated sprint quality, while a high FI value indicates a decline in performance due to accumulated fatigue (González-frutos et al., 2022).

The validity aspect shows that the RSA parameter has been proven to be significantly correlated with aerobic capacity ($VO_2max$), anaerobic capacity, and actual performance in team sports, thereby strengthening its position as a performance indicator (Archiza et al., 2020). The reliability aspect shows that the RSA protocol with a distance of 20–40 meters and 5–10
23 repetitions shows a high level of consistency, with an intraclass correlation coefficient (ICC) value generally >0.80 and a coefficient of variation (CV) <5%, making it suitable for use in repeated measurements (Kyles et al., 2023). The consistency of FI measurements is also considered adequate if the test procedure is strictly standardized (González-frutos et al., 2022).

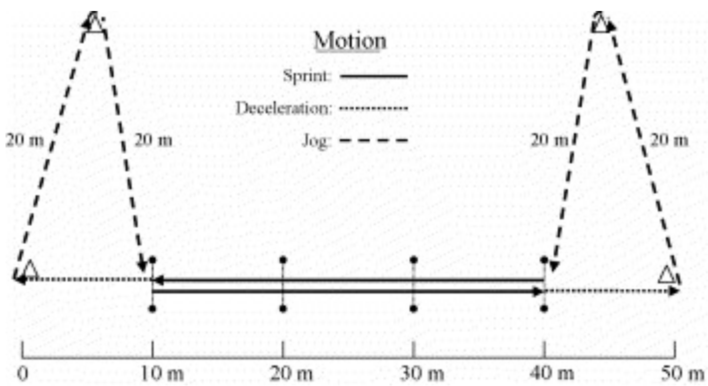


**Figure 1.** Repeated Sprint Ability Test (RSAT)

The assessment criteria in this test include Total Sprint Time, which is :
• Total Sprint Time: The total time for 6 sprints (seconds).
• Best Sprint Time: The fastest sprint in a single session.
• Fatigue Index (FI): The lower the FI, the better the tolerance to fatigue.

$$FI\ (\%) = \frac{(\text{Final Sprint Time} - \text{Best Sprint Time})}{\text{Best Sprint Time}} \times 100\%$$

**Figure 2.** Assessment Formula RSA

This Repeated Sprint Ability (RSA) training program is designed for 4 microcycles with a frequency of 3 sessions per microcycle, to improve speed endurance and consistency in repeated sprints for Rugby Sevens backs. Each session begins with a 15-minute warm-up, which includes light jogging, joint mobility, and progressive short sprints to ensure physiological readiness, increase blood flow to the muscles, and minimize the risk of injury before the core training (Dewi & Rahayu, 2025).

The core training consists of various forms of linear sprints, shuttle sprints, zig-zag sprints, change of direction (COD), curve sprints, and multidirectional sprint combinations, progressively arranged from 90% to 100% of maximum capacity. Sprint distances vary between 10–45 meters, with the number of sets and repetitions adjusted to mimic the intermittent high-intensity demands of Rugby Sevens matches (Brahim et al., 2023). The recovery time between sprints varies from 30 to 120 seconds depending on the intensity and complexity of the exercise, with the aim of stimulating adaptation in phosphocreatine resynthesis, neuromuscular efficiency, and tolerance to metabolite accumulation (Sant'Ana et al., 2024).

**Table 1.** RSA Training Program (4 Weeks)

| Session | RSA Training | Set | Repetition | Intensity | Rest |
|---|---|---|---|---|---|
| | RSA linear 20 m | 6 | 1 | | |
| 1 | Shuttle sprint 10–10 m | 8 | 1 | | |
| | Mini RSA 15 m | 4 | 1 | | |
| | RSA 15 m | 6 | 1 | | |
| 2 | Zig-zag sprint 20 m | 8 | 1 | 90% | |
| | RSA backward–forward 10 m | 4 | 3 | | |
| | RSA 25 m | 6 | 1 | | |
| 3 | COD sprint 45° 20 m | 8 | 1 | | |
| | RSA curve sprint 30 m | 6 | 2 | | 30 Sec |
| | RSA 30 m | 4 | 1 | | |
| 4 | Shuttle sprint 10–20–10 m | 6 | 1 | | |
| | RSA diagonal 20 m | 4 | 2 | | |
| | RSA 30 m | 4 | 1 | | |
| 5 | COD sprint 90° 20 m | 6 | 1 | 92.5% | |
| | RSA lateral sprint 40 m | 4 | 2 | | |
| | RSA multidirectional 20 m | 4 | 1 | | |
| 6 | Zig-zag run speed footwork 20 m | 4 | 2 | | |
| | RSA crossover sprint 20 m | 4 | 3 | | |
| | RSA 35 m | 3 | 1 | | |
| 7 | Repeated shuttle sprint 5-10-15 m | 3 | 2 | | |
| | RSA curve + linear combo 40 m | 3 | 4 | 95% | 60 Sec |
| 8 | RSA 40 m | 4 | 1 | | |
| | Reactive COD sprint | 4 | 3 | | |

| | | | | | |
|---|---|---|---|---|---|
| | RSA split sprint (20+20 m) | 3 | 3 | | |
| | RSA multidirectional 30 m | 3 | 1 | | |
| 9 | COD sprint 180° 20 m | 4 | 2 | | |
| | RSA chaos drill | 3 | 3 | | |
| | RSA 40 m | 3 | | | |
| 10 | RSA + COD 180° | 4 | | | |
| | RSA acceleration burst 45 m | 3 | | | |
| | RSA game-based backs position 40 m | 3 | | | |
| 11 | Reactive sprint–decision | 4 | 1 | 100% | 120 Sec |
| | RSA chase sprint | 3 | | | |
| | RSA multidirectional complex | 3 | | | |
| 12 | Sprint–COD–Sprint combo | 3 | | | |
| | RSA fatigue-finisher | 2 | | | |

In Table 1 it can be seen throughout the core training, athletes are in a state of high-intensity intermittent effort, facing a real accumulation of fatigue that demands speed control, technical coordination, and cognitive focus on each sprint or combination of movements (Hammami & Bouhlel, 2017). This program is designed to allow athletes to experience physiological and metabolic stress similar to open play situations in a match, so that the adaptations gained can be directly applied to field performance (Lorenz, 2016).

Following the core workout, a 15-minute cool-down is conducted, including light jogging and dynamic stretching to support recovery, gradually lower heart rate, and prevent muscle stiffness (Ben Brahim et al., 2026). During the program, pre-intervention measurements of athletes' initial performance were taken using BST, MST, and FI, while post-intervention measurements were taken using the same protocol after 4 micro-intervals to evaluate changes in repeated sprint performance and physiological recovery ability.

***Statistical analysis***

Data analysis was performed through statistical description, normality test, hypothesis testing (paired t-test and independent t-test), and percentage of results. Statistical analysis was performed using IBM SPSS Statistics (version XX, IBM Corp., Armonk, NY, USA). Descriptive statistics were calculated and presented as mean ± standard deviation to summarize the characteristics of the data. Prior to hypothesis testing, the normality of the data distribution was assessed using the Shapiro–Wilk test, considering the relatively small sample size ($n < 50$). A significance level (alpha) of 0.05 was set for all statistical tests.

For variables that met the assumption of normal distribution, parametric tests were applied. Specifically, paired sample t-tests were used to examine within-group differences between pretest and posttest values, while independent sample t-tests were conducted to analyze differences between the experimental and control groups. For variables that violated the normality assumption, appropriate non-parametric alternatives were considered to ensure the robustness of the analysis. All statistical tests were two-tailed, and effect interpretations were based on p-values and the magnitude of changes observed. Effect sizes were also calculated to provide a practical interpretation of the magnitude of differences.

**Results**

Descriptive statistic can be seen in Table 2.

**Table 2.** Descriptive Statistics of Speed, Endurance, and Fatigue Index Variables in the Experimental and Control Groups

| Variable | Group | Test | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|---|---|
| Speed Endurance (SE) | Eksperimental | Pre | 10 | 7.47 | 9.46 | 8.516 | .670 |
| | | Post | 10 | 7.33 | 8.91 | 8.176 | .559 |
| | Control | Pre | 10 | 7.63 | 9.52 | 8.551 | .582 |
| | | Post | 10 | 7.36 | 9.31 | 8.425 | .595 |
| Fatigue Index (FI) | Eksperimental | Pre | 10 | .06 | .17 | .0880 | .031 |
| | | Post | 10 | .02 | .11 | .0500 | .028 |
| | Control | Pre | 10 | .04 | .20 | .0890 | .044 |
| | | Post | 10 | .04 | .12 | .0780 | .026 |

Based on Table 2, all groups consisted of 10 athletes (N = 10) in each measurement phase. In the SE variable, the experimental group showed a pretest mean of 8.516 ± .670 with a range of 7.47–9.46, then experienced a decrease in time on the posttest to 8.1760 ± .559 with a range of 7.33–8.91. This decrease in the mean time indicates an increase in the ability to maintain repeated sprint speed after the RSA training intervention.

The control group also experienced a decrease in the average from 8.551 ± .582 (range 7.63–9.52) in the pretest to 8.425 ± 0.595 (range 7.36–9.31) in the posttest. However, the magnitude of change in the control group was smaller than that in the experimental group, so descriptively, the improvement in performance was more pronounced in the group that received the RSA training intervention.

In the FI variable, the experimental group showed a decrease in the mean from .088± .031 (range .06–.17) to .050 ± 0.028 (range .02–.11). This decrease reflects an increase in tolerance to fatigue and recovery ability between sprints. Meanwhile, the control group experienced a relatively small decrease, from .089 ± .044 (range .04–.20) to .078 ± .0261 (range .04–.12). Descriptively, the greater change in the experimental group indicates that RSA training has a more pronounced effect on increasing speed endurance and decreasing fatigue index compared to conventional training. The result of the normality calculation can be seen in Table 3.

**Table 3.** Normality Test of Speed Endurance and Fatigue Index Variables in the Experimental Group and Control Group

| Variable | Group | Test | df | Statistic | Sig. |
|---|---|---|---|---|---|
| Speed Endurance (SE) | Eksperimental | Pre | 10 | .928 | .424 |
| | | Post | 10 | .914 | .308 |
| | Control | Pre | 10 | .980 | .964 |
| | | Post | 10 | .950 | .664 |
| Fatigue Index (FI) | Eksperimental | Pre | 10 | .725 | .002 |
| | | Post | 10 | .818 | .024 |
| | Control | Pre | 10 | .813 | .021 |
| | | Post | 10 | .954 | .718 |

Based on Table 3, normality testing was performed using the Shapiro–Wilk procedure because the sample size in each group was relatively small (n = 10). For the SE variable, all data in both the experimental and control groups, in the pretest and posttest phases, showed significance values (Sig.) greater than 0.05 (p = .308–.964). These results indicate that the data are normally distributed, thus fulfilling the assumption for the use of parametric statistical analysis.

Conversely, for the FI variable, most of the data showed significance values less than 0.05, namely in the experimental pretest (p = .002), experimental posttest (p = .024), and control pretest (p = .021), which means that the data were not normally distributed. Only the control group posttest showed a normal distribution (p = .718). These findings indicate that the data are not normally distributed, so in further analysis, it is necessary to consider a statistical approach that is appropriate for the characteristics of the data distribution.

Although the Fatigue Index (FI) variable showed deviations from normality in several groups based on the Shapiro–Wilk test ($p < .05$), parametric tests were still applied. This decision was based on evidence that t-tests are relatively robust to moderate violations of normality, particularly when sample sizes are equal and group sizes are small but balanced. Additionally, the analysis focused on mean differences, which remain interpretable under such conditions. The data obtained form test result can be seen in Table 4.

**Table 4.** Effectiveness Test Before and After Treatment

| Variable | Group | Sig. | Effect Size (Cohen's d / r) | Description |
|---|---|---|---|---|
| Speed Endurance (SE) | Experimental | < .001 | .70 (d) | $H_0$ rejected |
| | Control | .034 | .35 (d) | $H_0$ rejected |
| Fatigue Index (FI) | Experimental | .008 | .62 (r) | $H_0$ rejected |
| | Control | .399 | .15 (r) | $H_0$ accepted |

9 Based on the hypothesis test results, the SE variable in the experimental group showed a statistically significant improvement ($p < .001$), with a moderate-to-large effect size (d = .70), indicating a substantial practical impact of the RSA training intervention. The control group also demonstrated a significant change (p = .034), although the effect size was smaller (d = .35), suggesting a less pronounced improvement compared to the experimental group. For the Fatigue Index (FI), the experimental group showed a significant reduction (p = .008) with a moderate effect size (r = .62), indicating improved fatigue tolerance following the intervention.
20 In contrast, the control group did not show a statistically significant change (p = .399), with
14 only a small effect size (r = .15). The data obtained form the difference test result can be seen in Table 5.

24 **Table 5.** Test of Difference in Effect between the Experimental Group and the Control Group

| Variable | Sig. | Description |
|---|---|---|
| Speed Endurance | .348 | $H_0$ accepted |
| Fatigue Index | .023 | $H_0$ rejected |

25 Based on Table 5, the results of the test of the difference in effect between the experimental group and the control group show that for the SE variable, a significance value of p = .348 ($p > .05$) was obtained, so $H_0$ is accepted. This finding indicates that there is no significant difference in effect between the two groups in terms of SE improvement.

Conversely, for the FI variable, a significance value of p = .023 ($p < .05$) was obtained, so $H_0$ is rejected. These results indicate a significant difference in effect between the experimental group and the control group, meaning that Repeated Sprint Ability (RSA) training

12 has a more effective impact on reducing fatigue index compared to conventional training. The percentage data can be seen in Figure 3.

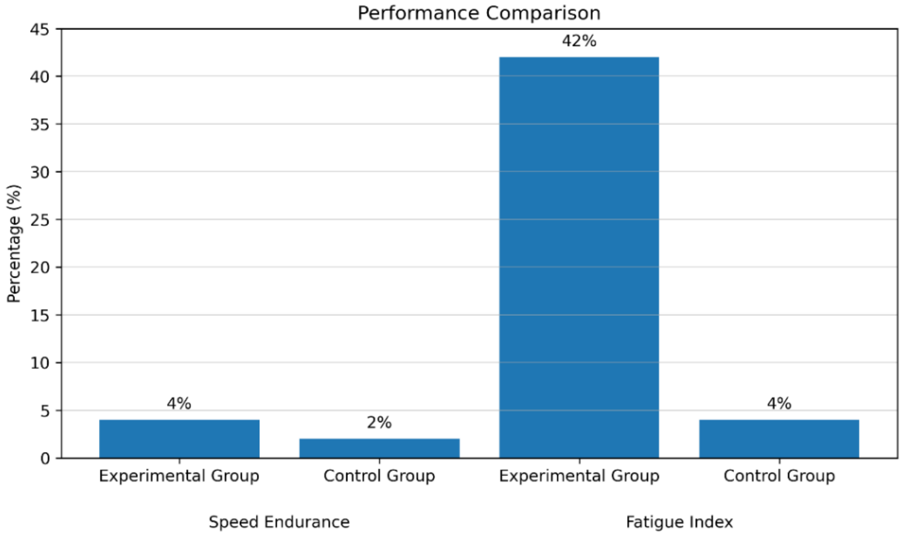


**Figure 3.** Percentage Increase in Speed Endurance Ability and Decrease in Fatigue Index

Based on Figure 3, the percentage change shows that the experimental group experienced a 4% increase in SE, while the control group only experienced a 2% increase. This difference in improvement indicates that the Repeated Sprint Ability (RSA) training intervention provides a more effective adaptation stimulus in improving the ability to maintain repeated sprint speed compared to conventional training. Although statistically the difference between groups on the SE variable was not significant (p = .348), descriptively there was a tendency for greater improvement in the experimental group.

More prominent findings were seen in the Fatigue Index (FI) variable. The experimental group showed an average decrease of 42%, while the control group only decreased by 4%. Considering that a lower FI value indicates better fatigue tolerance, a 42% decrease represents a substantial improvement in recovery capacity and resistance to fatigue accumulation. These results are consistent with the between-group difference test, which showed a significance value of p = .023. Therefore, it can be statistically stated that RSA training has a more effective influence on reducing fatigue index than regular training.

There was individual variation in the raw data, especially in the control group, which showed unstable values. However, the pattern of FI decline in the experimental group was more consistent and significant, so it can be assumed that the results were not coincidental. In addition to the effects of structured intervention, the improvements that occurred may also have been influenced by the athletes' independent training outside of the research sessions. In the context of regional coaching, athletes have additional physical activity and nutrition frequencies that can strengthen adaptation and recovery stimuli. Therefore, the combination of a systematic RSA program and consistent independent training activities enabled a significant increase in fatigue tolerance capacity in the experimental group.

## Discussion

### The Effect of Repeated Sprint Ability Training on the Speed Endurance of Backs in Bandung City Rugby Seven

Research results showing a significant increase in sprint and repeated sprint ability (RSA) in backs athletes after an RSA training program can be explained through physiological and neuromuscular mechanisms triggered by the training stimulus. RSA training directly simulates the highly intermittent demands of rugby sevens matches, which involve intense sprints followed by brief recovery periods, leading to metabolic adaptations that enhance both anaerobic and aerobic capacity simultaneously (Rey et al., 2019). These findings are supported by evidence showing that RST (Repeated Sprint Training) improves overall repeated sprint performance and aerobic/anaerobic capacity relevant to the demands of team sports (Thurlow et al., 2023).

In addition, the findings of this study are in line with a number of literature reviews state that Repetitive Sprint Training (RST) has a positive effect on speed performance and recovery capacity in team sports, provided that the training program is well designed (volume, intensity, and sprint modification). For example, meta-analyses and systematic reviews indicate that high-intensity repeated sprint training can enhance maximum speed, average repeated sprint performance, and recovery capacity, all of which are crucial components of the physiological profile of rugby sevens backs (Osses-Rivera et al., 2024). This aligns with findings that repeated sprint training can improve sprint performance and trigger positive adaptations in muscle energy structures, which have been demonstrated in elite rugby sevens players (Pramkratok et al., 2022).

This research is also in line with the results of studies that found the effectiveness of RST in improving repeated sprint ability and related physical performance. A (Wang et al., 2025) showed that a 6-week RST program provided significant improvements in aerobic and anaerobic capacity in rugby players, indicating stronger physiological adaptations compared to conventional interval training. Based on a systematic review, optimal RSA results are not only influenced by sprint training alone but also by a combination with resistance training, plyometrics, and specific small-sided games to approximate the demands of real games, which is relevant for rugby sevens backs who require rapid acceleration and maximal running speed in game situations (Sanz-Matesanz et al., 2025).

Based on the results of the intergroup difference test on the Speed Endurance variable, there was no significant difference between the group that underwent RSA training and the group that underwent conventional training. These findings indicate that both training methods provide relatively comparable stimuli to the ability to maintain average speed during a series of sprints. In other words, improvements in Speed Endurance performance are not exclusively influenced by the RSA model, but can also be developed through conventional training that still involves elements of speed and endurance. The graph visualization reinforces the statistical results by showing that the average increase in Speed Endurance in the experimental group was ±4%, while in the control group it was around ±2%.

Therefore, the results of this study have strong practical implications in the context of rugby sevens physical training. First, a structured RSA program can be implemented as a mandatory component in the physical cycle of backs players to improve repetitive speed performance. This is a crucial determinant in performance during attack, defense, and counter-attack transitions. It can help bridge the fitness gap that often exists between technical-tactical training and the physical demands of the game (Thurlow et al., 2023). Second, the implementation of RSA training can help coaches develop more efficient training periodization for the simultaneous development of anaerobic and aerobic capacity, which is crucial for backs who frequently perform repeated short sprints throughout the match (Shaun et al., 2024). Third, for athletes themselves, understanding effective RSA training can improve physical readiness, reduce the risk of premature fatigue during matches, and enhance overall performance in terms of sprint speed and endurance, which has been scientifically proven to be relevant for team sports performance such as rugby sevens (Osses-Rivera et al., 2024).

**The Effect of Repeated Sprint Ability Training on the Fatigue Index of Backs Players in Bandung City Rugby Seven**

The significant decrease in the Fatigue Index (FI) in the experimental group shows that the Repeated Sprint Ability (RSA) training intervention effectively improves athletes' ability to withstand performance decline due to accumulated fatigue during repeated sprints. This is crucial for backs players, who in Rugby Sevens are required to perform rapid accelerations and intermittent attacking and defensive transitions with minimal recovery time (Di Mascio et al., 2020). Physiologically, the improvement in FI reflects an increase in athletes' capacity to maintain high work output despite a decrease in phosphocreatine reserves and an increase in the contribution of aerobic metabolism to the recovery process (Pretorius et al., 2024). This ability allows backs to remain competitive in open play situations until the final phase of the game without experiencing a drastic decline in speed. The effectiveness of RSA training in reducing this fatigue index is driven by simultaneous hybrid adaptation of the anaerobic and aerobic energy systems. Training stimuli with maximum intensity (90-100%) and limited rest intervals force the body to increase the efficiency of phosphocreatine resynthesis and tolerance to the accumulation of metabolites such as hydrogen ions (H+) (Selmi et al., 2023).

Additionally, programs involving movement variations such as shuttle sprints and changes of direction (COD) trigger neuromuscular adaptations in the form of improved motor unit synchronization and more efficient intramuscular coordination (Chaniago et al., 2025). As a result, athletes not only become faster in single sprints but also more consistent in maintaining average sprint quality throughout repetitions (Curovic et al., 2024). These findings align with the majority of previous studies confirming that Repeated Sprint Training (RST) has a positive impact on the physiological profile and recovery capacity of team sport athletes. Research by (Thurlow et al., 2023) confirms that RST improves repeated sprint performance, which is relevant to the demands of high-intensity physical competition. In line with this, a study by (Osses-Rivera et al., 2024) shows that high-intensity sprint training can significantly improve recovery ability and maximum speed. In this study, a 4-week duration with a frequency of 3 sessions per micro proved to provide sufficient overload stimulus to trigger meaningful physiological adaptations. This is supported by the findings of (Wang et al., 2025), which state that a systematically structured training program provides a stronger increase in aerobic and anaerobic capacity compared to regular interval training.

Based on the results of the between-group difference test on the Fatigue Index variable, there was a significant difference in the effect between the group that underwent RSA training and the group that underwent conventional training. These findings indicate that RSA training provides a more specific and effective stimulus in improving athletes' ability to maintain sprint quality under fatigue conditions. In other words, the decrease in Fatigue Index is more influenced by the characteristics of RSA training, which emphasizes repeated maximal sprints with limited recovery time, so that the adaptation that occurs is more directed at increasing recovery capacity between sprints and resistance to the accumulation of metabolic fatigue. The graph visualization reinforces these statistical results by showing that the percentage decrease in the Fatigue Index in the experimental group was much greater than in the control group. The experimental group experienced a decrease of approximately ±42%, while the control group only experienced a decrease of approximately ±4%. This percentage difference confirms that RSA training has a more significant practical and statistical impact in reducing fatigue levels during repeated sprints, making it more effective than conventional training in improving fatigue tolerance.

The practical implications of this study suggest that RSA training may be considered as a complementary component in the physical preparation cycle of backs to help address the gap between technical training and the physical demands of the game. Through this approach, athletes may improve their ability to maintain sprint quality, enhance recovery between repeated efforts, and delay the onset of fatigue, thereby supporting more stable performance throughout the match. In addition, physical trainers could integrate Speed Endurance and Fatigue Index indicators as objective monitoring tools to evaluate athletes' progression in repeated sprint performance and fatigue tolerance on a regular basis (Coyne et al., 2022).

**Conclusions**

Based on the results of the study, it can be concluded that Repeated Sprint Ability (RSA) training has a significant effect on improving the speed endurance of Bandung City rugby sevens backs, particularly in terms of reducing the Fatigue Index. The experimental group showed a greater increase in Speed Endurance and a greater reduction in fatigue index compared to the control group. Although the differences between the groups in the Speed Endurance variable did not show statistical significance, descriptively, the group that received the RSA intervention still showed a better improvement trend. The most prominent finding was in the Fatigue Index variable, where RSA training proved to be more effective than conventional training in improving the ability to maintain sprint quality under fatigue conditions (Castillo-Rodríguez et al., 2023).

Several limitations should be acknowledged. First, the relatively small sample size (n = 10 per group) may limit the generalizability of the findings. Second, the short intervention duration (4 weeks) may not fully capture long-term training adaptations. Third, the inclusion of both male and female athletes without sex-based analysis may introduce potential variability in physiological responses. Fourth, the study did not control for athletes' independent training activities outside the intervention sessions, which may have influenced the results. Finally, the absence of physiological markers limits the ability to explain the underlying mechanisms of performance improvement. Therefore, future research is recommended to involve larger sample sizes, longer intervention periods, sex-specific analysis, and the inclusion of physiological measurements to provide a more comprehensive understanding of RSA training adaptations in rugby sevens.

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**Conflict of interest**

We declare no conflict of interest in this article.

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