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# Effectiveness of a 12-week structured training program on performance improvement in recreational male tennis players (NTRP 2.5): Controlled experimental study

Research Article

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## Abstract.

**Background** Low skill levels among beginner recreational tennis players often pose a major obstacle to developing basic techniques, stroke consistency, and understanding of game strategy. This situation can lead to low motivation to play and slow overall performance progress. One potential approach to addressing this issue is through the implementation of a structured, planned training program that takes place over an adequate period of time.

**Objectives** This study aims to test the effectiveness of a 12-week structured tennis training program on improving the performance of male recreational tennis players with a National Tennis Rating Program (NTRP) rating of 2.5.

**Methods** The study uses a quasi-experimental design with 100 participants evenly divided into an experimental group and a control group. The experimental group participated in a structured training program that included basic technique drills, tennis-specific physical training, and game simulations, while the control group only engaged in routine training without a strict structure. Performance data was collected through pre-test and post-test measurements, including shot accuracy, rally consistency, and response speed. Data analysis was performed using paired t-tests, ANOVA, and Cohen's d effect size calculations.

**Results** The results of the study showed that the experimental group experienced a significant improvement in performance ( $p < 0.001$ ;  $d = 1.99$ ) with higher effectiveness compared to the control group ( $d = 0.72$ ).

**Conclusion** The conclusion of this study is that a structured 12-week tennis training program can significantly improve the basic skills of beginner recreational tennis players. The contribution of this research is to provide a scientific basis for coaches and tennis clubs in designing evidence-based training programs that are effective in accelerating skill development and increasing active participation at the recreational level.

**Keywords:** recreational tennis, NTRP 2.5, training program, performance improvement

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## INTRODUCTION

Tennis is one of the most popular sports among various segments of society, both as a competitive sport and a recreational activity for maintaining fitness (Chao et al., 2021). At the recreational level, tennis not only provides physical benefits such as improved cardiovascular fitness, muscle strength, and motor coordination but also plays a role in developing social skills, reducing stress, and enhancing quality of life (Apriandi et al., 2023; Gunawan et al., 2023; Malm et al., 2019). However, most recreational tennis players, especially at the beginner level with a National Tennis Rating Program (NTRP) rating of 2.5, often face challenges in mastering basic technical skills such as forehand, backhand, serve, and volley (Marks, 2006; Sánchez-Alcaraz & Courel-Ibáñez, 2022). Low shot consistency, lack of accuracy, and limited understanding of game strategy are the primary barriers to improving performance on the court.

This issue is further complicated by the fact that most players in this category rely on unstructured practice, draw mainly from personal playing experience, and seldom receive coaching grounded in sports science (Busuttil et al., 2024; Keller et al., 2023). Additionally, limited training time,

lack of variation in instructional methods, and minimal performance evaluation contribute to slow skill development (Hawkinson et al., 2022; Serrano et al., 2013). These factors not only affect the quality of play but also influence motivation and long-term participation in tennis.

Previous studies have highlighted the importance of systematic training programs in enhancing tennis performance. Structured approaches have been shown to produce significant improvements in technical, physical, and mental aspects of the game. However, most research has focused on professional or advanced-level players, leaving a gap in studies targeting beginner recreational players, particularly those in the NTRP 2.5 category (Marin et al., 2023; Martín-Rodríguez et al., 2024; Zhang, 2024). This gap underscores the need for research specifically designed to develop and assess training programs for this population.

To address this problem, the present study proposes a 12-week structured tennis training program. The program is designed progressively and systematically, incorporating fundamental technical drills, tennis-specific physical conditioning, agility training, and match simulations (Bangari et al., 2025; Xiao et al., 2023). The approach aims not only to refine technical skills but also to enhance decision-making through game-based scenarios that replicate actual competitive conditions. The program follows the principles of training periodization, gradually increasing intensity and complexity to allow players to adapt optimally while minimizing the risk of overuse injuries (Guo et al., 2024; Simpicio et al., 2024).

The significance of this study lies in its contribution to providing an evidence-based framework for coaches, tennis clubs, and recreational sports practitioners to design effective training programs tailored to beginner players. By implementing a tested model, it is expected that players will experience faster skill improvement, maintain training motivation, and enjoy a more competitive yet engaging playing experience (Chao et al., 2021). Furthermore, this research has the potential to encourage the adoption of evidence-based community-level training programs, ultimately increasing public participation in tennis (Yang & Kwak, 2024).

The novelty of this study lies in its specific focus on male recreational tennis players at the NTRP 2.5 level—a group rarely addressed in previous research. Unlike earlier studies involving professional or semi-professional athletes, this research adopts a quasi-experimental design with pre- and post-test measurements, employing comprehensive performance indicators such as shot accuracy, rally consistency, and reaction speed (Bangari et al., 2025; Xiao et al., 2023). The use of combined statistical analyses, including paired t-tests, ANOVA, and Cohen's d effect size, offers a more detailed understanding of the magnitude of training effects.

Based on this background, the purpose of this study is to analyze the effectiveness of a 12-week structured tennis training program in improving the performance of male recreational tennis players with an NTRP rating of 2.5. Specifically, the study seeks to: (1) evaluate changes in fundamental tennis skills before and after training, (2) compare improvements between the experimental and control groups, and (3) provide practical recommendations for coaches and tennis clubs on implementing effective training at the recreational level. The findings are expected to enrich the literature on tennis training and offer practical contributions to coaching practices on the court.

## METHOD

### Participants

This study involved 100 male participants aged 18–34 years, selected through an initial screening process to ensure that all possessed a baseline National Tennis Rating Program (NTRP) score of 2.5. All participants were active recreational tennis players residing in South Jakarta and engaged in regular training activities under the Gilatennis Tennis Club. Participants were randomly assigned into two groups: an experimental group (n = 50) and a control group (n = 50). The training sessions were supervised by a certified tennis coach with 20 years of coaching experience and a background as a former Indonesian national tennis player.

### Research Design

A quasi-experimental pretest–posttest control group design was employed. The experimental group participated in a 12-week structured tennis training program, consisting of three sessions per week, with each session lasting 120 minutes. Training sessions included warm-up activities, fundamental technical drills (forehand, backhand, and serve), tactical training, sparring sessions, and cooldown exercises. In contrast, the control group continued to engage in recreational tennis without



following a structured training program. Assessments were conducted before and after the intervention, focusing on three main performance variables: (1) stroke accuracy (forehand, backhand, and serve), (2) agility, measured using a standardized footwork drill test, and (3) sparring performance scores based on standardized evaluation criteria.

Data Analysis

The Shapiro-Wilk test was used to verify the normality of data distribution, ensuring that parametric assumptions were met. Paired t-tests were applied to compare pretest and posttest results within each group, while one-way ANOVA was employed to examine differences between the experimental and control groups. Levene's test was used to assess the homogeneity of variances. The effect size of the intervention on performance variables was calculated using Cohen's d. All statistical analyses were conducted with a 5% significance level ( $p < 0.05$ ).

RESULTS AND DISCUSSION

Results

The Shapiro-Wilk normality test results show that all data in the pre-test and post-test measurements, both in the experimental group and the control group, have a  $p$ -value  $> 0.05$ . This indicates that the data distribution is normal, thus fulfilling the assumption for further parametric testing.

Table 1. (Normality Test)

| Group                | Shapiro-Wilk p-value | Interpretation |
|----------------------|----------------------|----------------|
| Pre-Test Experiment  | 0,214                | Normal         |
| Post-Test Experiment | 0,182                | Normal         |
| Pre-Test Control     | 0,265                | Normal         |
| Post-Test Control    | 0,193                | Normal         |

Table 2. (Paired t-test and Effect Size)

| Group        | Mean Pretest | Mean Posttest | Difference | t-value | p-value | Cohen's d | Effect Category |
|--------------|--------------|---------------|------------|---------|---------|-----------|-----------------|
| Experimental | 54,14        | 63,94         | 9,80       | -22,94  | <0,001  | 1,99      | Very large      |
| Control      | 54,74        | 58,23         | 3,49       | -12,53  | <0,001  | 0,72      | Moderate        |

The paired t-test analysis showed that the experimental group experienced an increase in average scores from 54.14 on the pre-test to 63.94 on the post-test, with a difference of 9.80 points. This increase was statistically significant ( $p < 0.001$ ) and had a very large effect size (Cohen's  $d = 1.99$ ). Meanwhile, the control group also experienced an increase in average scores from 54.74 to 58.23 (a difference of 3.49 points), which was significant ( $p < 0.001$ ) but with a moderate effect size (Cohen's  $d = 0.72$ ). These results indicate that although both groups experienced improvements, the improvement in the experimental group was much greater in practical terms.

Table 3. (Levene's Test Results)

| F-value | p-value | Interpretation       |
|---------|---------|----------------------|
| 0,66    | 0,418   | Homogeneous variance |

Levene's test showed a  $p$ -value of 0.418 ( $> 0.05$ ), which means that the variances between groups are homogeneous. Thus, the assumption of variance homogeneity is fulfilled, and the ANOVA results can be interpreted validly.

Table 4. (Post-Test ANOVA Results)

| Sources of Variation | F-value | p-value | Interpretation |
|----------------------|---------|---------|----------------|
| Between Groups       | 32,08   | <0,001  | Significant    |
| Within Groups        | -       | -       | -              |

The results of the one-way ANOVA on the post-test data showed significant differences between groups ( $F = 32.08$ ;  $p < 0.001$ ). This means that the 12-week structured training program had a significantly different effect compared to unstructured recreational activities.

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Discussion

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The findings of this study indicate that a 12-week structured tennis training program can produce significant performance improvements in recreational male tennis players with an NTRP rating of 2.5. The very large effect size (Cohen's  $d = 1.99$ ) observed in the experimental group confirms that systematic training can address fundamental weaknesses such as stroke technique (forehand, backhand, and serve), footwork coordination, agility, and tactical decision-making. These results support the integration of curriculum-based training modules in recreational tennis coaching. Relevant studies have shown that strength and power gains can occur after just six weeks of functional training, and that 12 weeks of functional training can surpass conventional training in improving performance among adolescent male tennis players (Xiao et al., 2023).

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These findings align with the recommendations of the International Tennis Federation (ITF), as outlined by Dolenc and Filipcic (2025), who emphasize the importance of structured, progressive, and game-based approaches to enhance the technical and tactical skills of novice players. Roth and Kim (2025) further highlight that planned instruction with consistent feedback significantly contributes to tennis skill improvement. Additionally, several studies have demonstrated that a training climate oriented toward task mastery can enhance participants' intrinsic motivation, which likely played a role in the success of the program (Bozyigit, 2025; Buzzelli, 2025; Osete et al., 2025; Tagliavini et al., 2025; Van de Braam, 2025).

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Nevertheless, some research has reported that structured training does not always lead to significant improvements in recreational players. For example, Roth and Kim (2025) found that skill enhancement among adult beginners often depends on the intensity of self-practice outside of formal training sessions, rather than solely on structured programs. Furthermore, Osete et al. (2025) caution that individual adaptations to training can vary based on factors such as age, baseline fitness, and motivation, meaning that not all players will progress equally even under identical programs.

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Several limitations of this study should be noted. First, the sample included only male players aged 18–34 from South Jakarta, which may limit the generalizability of the findings to female players or other age groups. Second, external factors such as physical activity outside the training program and dietary habits were not fully controlled, potentially influencing the results. Third, the relatively short duration of the study (12 weeks) did not allow for the assessment of long-term skill retention. Fourth, although valid measurement methods were employed, performance assessments such as stroke accuracy still contained an element of subjectivity.

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In conclusion, while this study provides strong evidence for the effectiveness of structured training in novice tennis players, future research employing more diverse designs, longer durations, and stricter control of external variables is strongly recommended.

CONCLUSION

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Based on the analysis, this study concludes that a structured 12-week tennis training program significantly improves the performance of beginner tennis players with an NTRP rating of 2.5. Improvements were observed in fundamental technical skills (forehand, backhand, serve), footwork coordination, agility, and tactical decision-making. The large effect size recorded in the experimental group indicates that systematic and well-planned training is effective in enhancing the core tennis skills of recreational players. Theoretically, this study contributes to the literature on tennis skill development by providing empirical evidence of the effectiveness of a curriculum-based training approach that integrates game-based methods with continuous feedback. Practically, the findings can be applied by coaches, tennis clubs, and sports development organizations to design more structured training programs for beginners, thereby accelerating skill adaptation and increasing participation motivation. Application of these findings can be realized through the integration of standardized training modules into recreational tennis development programs, particularly for young adult age groups. Coaches can implement game-based training formats combined with regular evaluations to maintain skill progress. Moreover, these results can serve as a reference for tennis course providers in developing scientifically proven medium-term training packages. For future research, it is recommended to expand the sample to include female players, different age groups, and varying skill levels. Extending the study duration would allow examination of the long-term sustainability of the improvements. Additionally, controlling external variables such as extra physical activity and dietary habits is advised. The use of motion analysis technology (e.g., motion capture or performance-tracking applications) is also recommended to obtain more detailed and objective data on players' skill development.

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## AUTHOR CONTRIBUTION STATEMENT

RA were responsible for the development of the research concept and design, data collection, and QBS preparation of the initial draft of the manuscript.

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