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Effectiveness of Progressive Muscle Relaxation in Reducing Competitive Anxiety in Athletes: A Systematic Review

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Abstract

Introduction: Athletes often experience high pressure during competitions, leading to competitive anxiety, which affects performance. Progressive Muscle Relaxation (PMR) is a technique that may help reduce anxiety in athletes. This review evaluates the effectiveness of PMR in lowering anxiety levels.
Methods: A systematic review was conducted using Google Scholar, PubMed, and Scopus, selecting 10 studies published between 2020 and 2025 with 337 participants. Inclusion criteria included experimental studies involving athletes with anxiety disorders, and the intervention was PMR. The studies were assessed using the PEDro scale, and a narrative synthesis was applied.
Results: The review found that PMR significantly reduced anxiety levels in athletes, showing effectiveness in both somatic and cognitive anxiety.
Conclusion: PMR is effective in reducing anxiety in athletes compared to other techniques. Age, athletic experience, and competition level should be considered when implementing PMR. Overall, PMR is a recommended mental training tool for reducing anxiety and optimizing performance in athletes.

Keywords: Progressive Muscle Relaxation, Athletes, Anxiety

Introduction

In competitive sports, athletes must be physically and mentally prepared to face challenges during competitions. This can affect their enjoyment, compliance, and participation in sports, consequently influencing their mood and making them vulnerable to anxiety.[1,2] Anxiety disorders are among the most common mental health issues. According to the World Health Organization (WHO), approximately 4% of the global population is currently affected by anxiety disorders. In 2019, 301 million people worldwide experienced anxiety disorders.[3] Due to the pressure and challenges faced in each competition, athletes are more susceptible to anxiety disorders compared to the general population. A study by Kruger (2025) involving 200 student-athletes revealed that 15% had severe anxiety, 6.5% had moderate anxiety, and 23.5% had mild anxiety.[4] This aligns with research by Åkesdotter et al. (2020) among 333 elite athletes, which found that 19.5% exhibited symptoms of anxiety and/or depression.[5]

Anxiety is a common experience when individuals are faced with new challenges that cause conflict or difficulty.[6–8] In sports, anxiety often occurs in competitive environments and is referred to as competitive anxiety.[9] Competitive anxiety arises when athletes feel incapable or fearful of performing in competition outcomes. It is a natural response to environmental threats, such as sports events, manifesting in physical and psychological reactions.[10] Excessive anxiety can result in physical symptoms such as muscle tension, heart palpitations, trembling, shortness of breath, fatigue, and coordination difficulties.[11,12] Psychological responses include mood swings, motivation changes, and concentration issues.[6,13] Competitive anxiety varies among athletes, closely linked to their psychological conditions. Competitive anxiety is categorized into three levels: low, moderate, and high. [10] Athletes with low competitive anxiety tend to prepare well before a competition, leading to optimal performance.[13] In contrast, athletes with high anxiety often struggle with concentration and stress management, negatively affecting their confidence and preventing optimal performance.[10,14]

Various techniques can be applied to athletes experiencing anxiety, one of which is relaxation techniques.[6,15] Relaxation techniques help individuals relax under pressure by inhibiting the sympathetic nervous system.[10,15] These techniques also focus on controlling excessive negative emotions during anxious conditions.[2] Once athletes reach a relaxed state, their concentration and focus improve, enhancing decision-making and confidence in competition.[2,6,16] One of the simplest and most accessible relaxation techniques is Progressive Muscle Relaxation (PMR).[9,17] PMR involves a contraction-relaxation technique (hold-relax) applied to various muscle groups from head to toe, as a stress management tool.[18–20] PMR is categorized as deep relaxation, based on the principle that muscle tension is a physiological response to intrusive thoughts.[6,7,21] PMR has been shown to enhance athletic performance, affecting physical and psychological aspects.[9,22] Physically, PMR reduces heart rate, aids in recovery, and improves overall athletic performance. Psychologically, PMR plays a role in improving emotional control, self-confidence, and concentration under pressure.[1,16,23]

Research by Irham et al. (2024) demonstrated that PMR significantly reduces anxiety levels in sepak takraw athletes. [24] This finding is consistent with Battaglini et al. (2022), where Jacobson's Progressive Relaxation technique was effective in reducing cognitive anxiety and stress related to sports, such as competition anxiety, fatigue, and overtraining.[1] The advantages of PMR include its ease of learning, lack of side effects, and applicability to all muscle locations.[7,12,14,25]

Although several experimental studies have highlighted the benefits of PMR for athletes, no systematic review has comprehensively summarized and evaluated this evidence. Therefore, systematic research is necessary to gain a deeper understanding of the effectiveness of PMR in managing anxiety among athletes. The objective of this systematic review is to evaluate the effectiveness of PMR techniques in reducing anxiety in athletes by comparing results from various available experimental studies. This study is expected to increase awareness of the importance of holistic physical and mental health in athletes and provide recommendations for mental health-focused training programs for athletes.

There are several limitations in this study. First, it involves a relatively small sample size. Second, there are variations in the age and experience levels of the athletes. Third, the competition levels varied. Therefore, further research is needed to examine the impact of age, training experience, and competition levels on anxiety and stress among athletes. Future studies with randomized clinical trials and larger sample sizes from various sports disciplines, exploring the effects of PMR post-competition and across different competition levels, are strongly recommended.

Methodology

This review utilizes a spectrum of literature consisting of experimental studies, focusing on interventions using Progressive Muscle Relaxation (PMR) applied to athletes from various sports disciplines. Specifically, the inclusion criteria are as follows: (1) Experimental studies (Randomized Controlled Trials or quasi-experimental); (2) Participants are athletes from various sports disciplines; (3) Studies published between 2020 and 2025; (4) Articles published in English. The search was conducted on February 2, 2025, using Scopus, PubMed, and Google Scholar databases. The keywords used were "Progressive Muscle Relaxation" AND "Athlete" AND "Anxiety." The exclusion criteria were: (1) Articles not in the form of experimental studies, (2) Articles lacking an abstract or full-text access, (3) Publications not in English, and (4) Participants who are not athletes. Two independent reviewers conducted the article selection process. In case of disagreement, discussions were held until a consensus was reached.

From the initial search, a total of 109 articles were identified. After removing seven duplicate articles, 102 articles remained. The selection process continued with screening based on titles and abstracts, resulting in 35 articles. A full-text review was then conducted, leading to the elimination of 11 articles, leaving 24 articles. Subsequently, 14 of the 24 articles were excluded due to being non-English or having less relevant research results, leaving 10 articles for further analysis.

This systematic review follows the guidelines established by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA), ensuring a rigorous and standardized approach (Figure 1). Data extracted from the articles included the research theme, author names, population, intervention, intervention duration, outcomes, and methods used based on the PICO framework (Population, Intervention, Comparison, Outcome). PICO served as a selection guide with the following details: Population: Athletes from various sports disciplines; Intervention: Progressive Muscle Relaxation training; Comparison: Other interventions or control groups; Outcome: Reduction in anxiety levels. The next step was to analyze the articles using the PEDro scale to assess the methodological quality. Articles with a PEDro score of ≥5 were considered moderate to high methodological quality and included in the analysis. The ten articles reviewed discussed the effects of PMR on reducing anxiety in athletes. The analysis was conducted narratively, comparing study results based on population characteristics, intervention duration, and key outcomes reported.

Results

The literature search for this study was systematically conducted through three major electronic databases: Scopus, PubMed, and Google Scholar. These databases were selected to ensure broad coverage of relevant scientific articles across health sciences, sports sciences, and psychology. The keywords "Progressive Muscle Relaxation," "Athlete," and "Anxiety" were used in combination with Boolean operators to refine the search strategy and enhance retrieval accuracy. This approach aimed to identify studies specifically examining the effect of Progressive Muscle Relaxation (PMR) on anxiety levels in athlete populations.

The article selection followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure methodological transparency and rigor. After the initial search, duplicate records were removed, and articles were screened based on titles and abstracts, followed by full-text assessments according to predefined inclusion and exclusion criteria. Only studies published in English, available in full text, and employing PMR interventions in athletes with measurable anxiety outcomes were included. The detailed flow of the article selection process is depicted in the PRISMA diagram presented in Figure 1.

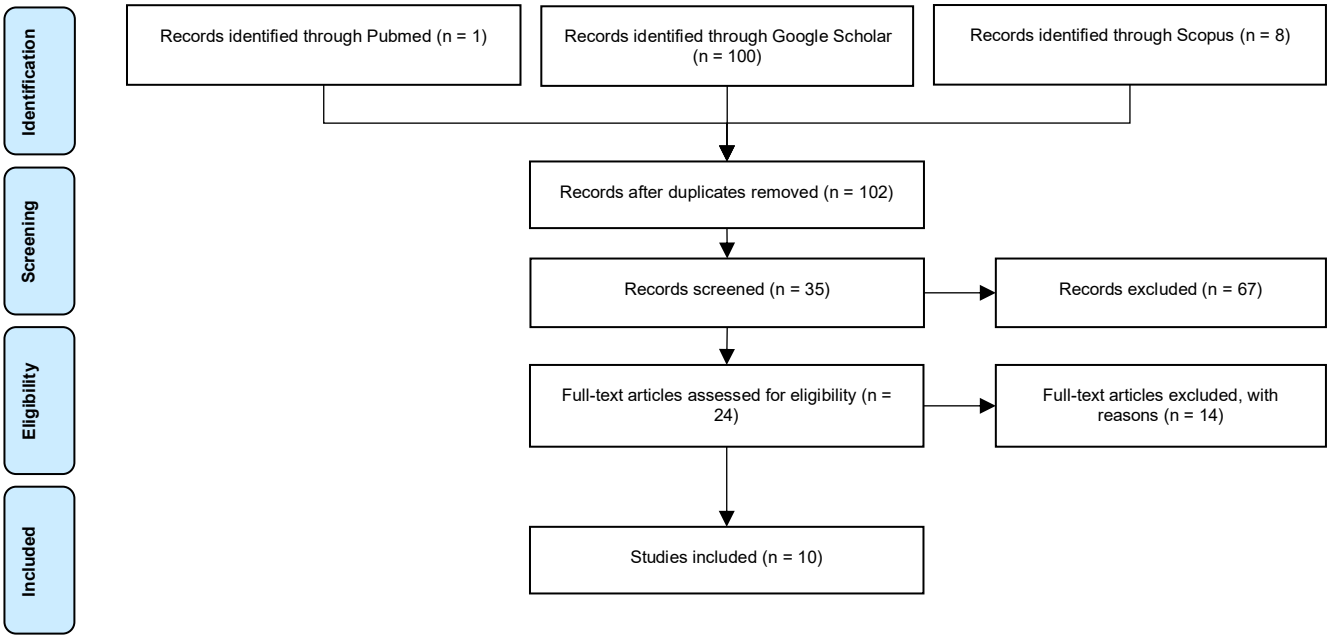

Figure 1. PRISMA Flow Diagram

Study Characteristics

Table 1 presents detailed, systematic PICO data for each study. This table outlines the characteristics of each study, including the reference, participant demographics, PMR intervention type, comparisons, outcomes, and study results (anxiety scores before and after intervention).

Table 1. PICO Analysis

Study Reference	Population	Intervention	Comparison	Outcome Measures	*Average Anxiety Score*	Anxiety Reduction (P-Value)
Irham et al. (2024)	15 sepak takraw athletes	Progressive Muscle Relaxation (PMR)	Experimental group (n=15)	Anxiety Instrument Grid	Pre-test: 51.27; Post-test: 40.67	10.6
Nien et al. (2023)	35 track and field athletes	PMR and Mindfulness Induction (MI)	PMR group, MI group, and control group	State Anxiety Inventory, PANAS, brain activity	Not explicitly stated in the article	P<0.001 (Significant)
Jannah et al. (2023)	12 shooting athletes	PMR for 8 sessions (2 sessions/week)	Experimental group (n=6) and control group (n=6)	Competitive Anxiety Scales	Experimental group: Pre-test: 58.67; Post-test: 36.5 Control group: Pre-test: 58.67; Post-test: 59.17	Experimental group: -22.17; Control group: +0.5
Battaglini et al. (2022)	59 male basketball athletes (aged 14–19 years)	PMR for 12 sessions (2 sessions/week)	Experimental group (n=29) and control group (n=30)	CSAI-2, Brunel Mood Scale, Recovery-Stress Questionnaire, ABQ	Not explicitly stated in the article	P=0.038 (Significant)
Ebrahimi et al. (2022)	45 female futsal athletes	PMR and orange essential oil inhalation for 8 sessions	PMR group (n=15), inhalation group (n=15), control group (n=15)	CSAI-2	Not explicitly stated in the article	P=0.0001 (Significant)
Jermaina et al. (2022)	38 novice athletes	PMR and Autogenic Relaxation (AGR) for 10 weeks	PMR group (n=20) and AGR group (n=20)	Zung Self-Rating Anxiety Scale	Not explicitly stated in the article	P>0.05 (Not Significant)
Purnomo et al. (2021)	55 high jump athletes	PMR	Experimental group (n=55)	Pre-test and post-test comparison	Pre-test: 38.53; Post-test: 14.60	23.93
Liang et al. (2021)	25 college athletes (athletics)	Progressive Relaxation Technique (PRT) for 4 weeks	Experimental group (n=14) and control group (n=10)	CSAI-2, STAI, EPQ-RSC	Experimental group: Pre-test: 21.36; Post-test: 17.43 Control group: Pre-test: 20.36; Post-test: 19.36	Experimental group: 3.93; Control group: 1.0
Tahir et al. (2021)	20 taekwondo athletes	PMR for 6 weeks (3 sessions/week)	Experimental group (n=10) and control group (n=10)	Anxiety questionnaire	Pre-test: 2.5524; Post-test: 1.5333	1.0191
Burhan and Vandita (2021)	33 football athletes (Persatu Darek FC)	PMR and Imagery Exercise (IE)	PMR group (n=11), IE group (n=11), control group (n=11)	Grid Concentration Exercise Test and Sport Anxiety Scale	Not explicitly stated in the article	PMR group: P=0.000 (Significant); IE group: P=0.003 (Significant); Control group: P=0.081 (Not Significant)

Intervention Types and Effectiveness

Out of the 109 articles, ten were selected for a systematic review. Seven studies employed a quasi-experimental design, two used a pre-post design, and one applied a crossover design. The total number of eligible and willing respondents across all studies was 337. The interventions reported in the literature primarily involved Progressive Muscle Relaxation (PMR), with several studies combining it with other non-medical therapies or complementary treatments. Six studies used PMR alone, while one study combined PMR with Mindfulness Induction (MI), one combined PMR with orange essential oil inhalation, one combined PMR with Autogenic Relaxation (AGR), and one combined PMR with Imagery Exercise (IE).

Table 1 illustrates that all studies support the effectiveness of PMR in reducing anxiety in athletes, with varying significance levels. Most studies reported a greater reduction in anxiety scores in the experimental groups than the control groups, as indicated by results showing P<0.05, which signifies statistical significance.

Table 2. PEDro Scale

Study	Irham et al. (2024)	Nien et al. (2023)	Jannah et al. (2023)	Battaglini et al. (2022)	Ebrahimi et al. (2022)	Jermaina et al. (2022)	Purnomo et al. (2021)	Liang et al. (2021)	Tahir et al. (2021)	Burhan & Vandita (2021)
Eligibility Criteria	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Random Allocation	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Concealed Allocation	x	x	x	x	x	x	x	x	x	x
Baseline Comparability	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Blinding of Subjects	x	x	x	x	x	x	x	x	x	x
Blinding of Therapists	x	x	x	x	x	x	x	x	x	x
Blinding of Assessors	x	x	x	x	x	x	x	x	x	x
Adequate Follow-up	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Intention-to-Treat Analysis	x	x	x	x	x	x	x	x	x	x
Between-Group Comparisons	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Point Measures & Variability Data	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Total	5	5	5	5	5	5	5	5	5	5
Quality	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium

Methodological Quality Assessment (PEDro Scale)

Table 2 presents the analysis of ten articles using the PEDro scale, which were classified as having medium methodological quality and indexed in international databases. The PEDro scale analysis reveals that all reviewed studies exhibited a relatively high risk of bias. This is attributed to the lack of concealed allocation, blinding of subjects, blinding of therapists, blinding of assessors, and intention-to-treat analysis. The absence of these assessment components increases the risk of selection bias, placebo effects, performance bias, and detection bias, which can affect the validity and objectivity of the research findings.

Although all studies used valid measurement instruments, the lack of control over potential methodological biases may hinder the conclusion of the effectiveness of Progressive Muscle Relaxation (PMR) in reducing anxiety among athletes. Therefore, further studies with stricter research designs are needed to ensure that the observed effects are entirely attributed to the PMR intervention.

However, despite the absence of several assessment components that could increase the risk of bias, all studies still met specific criteria, including random allocation, group equivalence, adequate follow-up, and between-group comparison of outcomes. The data were also presented comprehensively, including effect sizes and variability. Thus, despite the risk of bias, the study findings still provide valuable contributions and may serve as a foundation for future research.

Summary of Findings

A comprehensive evaluation of PMR has shown various benefits across different groups of athletes. Specifically, a consistent reduction in anxiety levels was observed among populations including athletes from multiple sports such as sepak takraw, track and field, futsal, basketball, shooting, high jump, athletics, taekwondo, and football. This demonstrates the potential effectiveness of PMR in reducing stress and anxiety among athletes, who often face a wide range of challenges.

Discussion

This systematic review included 10 articles that employed Progressive Muscle Relaxation (PMR) exercises, with some combined with other interventions, aimed at reducing anxiety levels in athletes. Seven exercise groups from seven studies reported a statistically significant reduction in anxiety in athletes ($p<0.05$), while three exercise groups showed a decrease in anxiety, though not statistically significant ($p>0.05$).

The study by Irham et al. (2024) involving 15 sepaktakraw athletes demonstrated that PMR effectively reduced anxiety levels. Unlike individual sports, sepaktakraw, a team-based sport, demands that athletes have good teamwork and mental conditioning to motivate one another. The athletes received PMR intervention for 60 minutes per session. The study utilized a pretest-posttest design, with anxiety measured before and after the intervention using the Anxiety Instrument Grid. The results showed a significant anxiety reduction ($p<0.05$), with the pretest average anxiety score being 51.27 and the posttest score 40.67, reflecting a decrease of 10.6. These findings indicate that PMR is effective in reducing anxiety in team-based sports, such as sepaktakraw.

Nien et al. (2023) conducted a study on track and field athletes to evaluate the short-term effects of PMR and Mindfulness Induction (MI) on anxiety, and to identify differences in brain activation between the two interventions through electroencephalography (EEG) analysis of theta and alpha waves. The State Anxiety Inventory (SAI) was used to measure anxiety levels. A two-way ANOVA showed a significant interaction between time and condition ($p = 0.004$), with a substantial reduction in SAI scores from pre-test to post-test after PMR ($p < 0.001$). However, similar reductions in anxiety were observed in the MI group, and no significant difference between PMR and MI was found ($p = 0.996$). The decrease in anxiety was associated with increased theta wave activation in the frontal brain regions, indicating enhanced internal attention control and cognitive regulation processes. These findings neurophysiologically support the effectiveness of PMR in managing anxiety through improved attention regulation and systemic relaxation.

Jannah et al. (2023) investigated the role of PMR in reducing competitive anxiety in shooting athletes. Using a pretest-posttest control group design, 12 athletes were randomly divided into the experimental group (6 athletes) and the control group (6 athletes). The experimental group received PMR for 4 weeks, with two sessions per week, while the control group received no intervention. Anxiety was measured using the Competitive Anxiety Scales. The experimental group showed a significant reduction in competitive anxiety ($p<0.001$), with the average pretest score of 58.67 dropping to 36.5, decreasing 22.17 points. Conversely, the control group experienced a slight increase in anxiety (0.5 points). PMR helped athletes enhance their awareness of the importance of maintaining psychological well-being, contributing to a reduction in anxiety during competitions.

Battaglini et al. (2022) found that PMR effectively reduced sports-related cognitive anxiety and stress. The study involved 59 basketball athletes aged 14 to 19 years, divided into an experimental group (29 athletes) and a control group (30 athletes). Competitive anxiety was measured using the Competitive State Anxiety Inventory-2 (CSAI-2) before and after the intervention. The experimental group underwent 12 PMR sessions (2 sessions per week), each lasting 30-40 minutes, while the control group received no intervention. A Mann–Whitney test revealed a significant reduction in cognitive anxiety in the experimental group compared to the control group ($p = 0.038$). Additionally, the study found substantial blood pressure and heart rate reductions in the experimental group ($p<0.05$), which were influenced by parasympathetic system activation. This physiological response supports the role of PMR in helping athletes recover after competitions.

Ebrahimi et al. (2022) compared the effectiveness of PMR and orange essential oil inhalation in reducing anxiety among 45 female futsal athletes. The study used a quasi-experimental design, comparing pre-test and post-test results across three groups: PMR (15 athletes), inhalation (15 athletes), and control (15 athletes). Both the PMR and inhalation groups showed a significant anxiety reduction compared to the control group ($p=0.0001$).

Purnomo et al. (2021) evaluated the effects of PMR on reducing anxiety in high jump athletes after training. The study employed a quasi-experimental nonequivalent control group design with 55 athletes. A paired t-test revealed a significant difference in anxiety levels and high jump performance before and after PMR intervention ($p=0.000$), indicating that PMR helped reduce anxiety and improve jump quality. Additionally, PMR positively affected athletes' confidence, particularly among beginners.

Burhan and Vandita (2021) analyzed the effects of Imagery Exercise (IE) and PMR on anxiety in soccer players, measured using the Sport Anxiety Scale. The study involved 33 soccer athletes divided into three groups: IE (11 athletes), PMR (11 athletes), and control (11 athletes). Both PMR and IE led to significant reductions in anxiety ($p<0.05$), while the control group showed no significant change. Unfortunately, the study did not report detailed anxiety score changes between pre-test and post-test.

In contrast, three studies showed differing results. Jermaina et al. (2022) found that PMR was not significantly effective in reducing anxiety in beginner athletes. This may be due to the relatively short intervention duration (10 weeks), low intensity, and potential lack of high baseline anxiety levels. Liang et al. (2021) reported that PMR did not significantly change somatic and cognitive anxiety in competitive athletes, likely due to limited intervention duration (30 minutes, twice per week for 4 weeks), high competitive pressure, and limited competition experience among college athletes. Additionally, Tahir et al. (2021) showed a positive response with reduced anxiety scores in the experimental group after PMR intervention, but the change was not statistically significant. This was attributed to a small sample size ($n=10$ per group), brief intervention (15 minutes per session, three times a week for 6 weeks), and a general anxiety measurement instrument that did not focus on competitive anxiety.

In conclusion, the synthesis of these studies indicates that PMR effectively reduces anxiety in athletes across various individual and team settings. PMR consistently significantly reduces competitive anxiety, enhances psychological comfort, and supports athletic performance, improving attention control, physiological relaxation, emotional stabilization, and self-confidence. The effectiveness is evident in the significant reduction in anxiety scores across several experimental and quasi-experimental studies with pretest-posttest designs. PMR also helps balance physiological responses such as blood pressure and heart rate, involving the parasympathetic nervous system in post-training or post-competition recovery. The statistical data indicate that PMR is a practical and effective mental training method.

However, the studies reviewed have limitations, including variations in methodology, measurement instruments, intervention duration, and frequency of PMR, making direct comparisons challenging. A lack of studies specifically

addressing the effectiveness of PMR in reducing anxiety in athletes also poses a challenge. Potential publication bias must also be considered, as studies with significant findings are more likely to be published. This is one of the reasons why this review did not perform a meta-analysis, as the data might not be accurate. A narrative synthesis approach was used to compare the findings and identify factors contributing to outcome differences across studies. Given the limitations, further research with more rigorous study designs and transparent data reporting is recommended to ensure that the observed effects are solely due to the PMR intervention.

Mechanism of Action of Progressive Muscle Relaxation (PMR)

The mechanism by which PMR affects anxiety is based on the interplay between the sympathetic and parasympathetic nervous systems, where the function of the sympathetic nervous system is inversely related to that of the parasympathetic system.[6] In situations of high anxiety, the sympathetic nervous system's activity increases excessively, manifesting in elevated heart rate, shortness of breath, muscle tension, and raised blood pressure as a response to heightened alertness.[11,24] With the application of PMR techniques, sympathetic nervous system activity is inhibited, leading to enhanced parasympathetic nervous system function.[6,9] This allows the body to rest briefly, facilitated by muscle relaxation, reduced respiratory rate, lowered heart rate, and decreased lactate levels.[1,10] A study by Battaglini et al. (2022) demonstrated that heart rate and respiratory rhythm were significantly reduced in the group receiving PMR intervention compared to the control group. Additionally, PMR has been shown to reduce cortisol levels and increase the secretion of endorphins, hormones crucial in lowering anxiety levels.[10,11]

Progressive Muscle Relaxation Exercises in Reducing Anxiety in Athletes

A study by Ebrahimi et al. (2022) indicated that applying PMR in anxious situations helps athletes regain a logical understanding and awareness of the situation, allowing them to interpret it as less threatening and more manageable. PMR serves as an action-based coping strategy that emphasizes the athlete's responses to stress and anxiety.[11,17] The use of coping strategies enables athletes to consciously evaluate the anxiety symptoms they experience during competition, creating a positive perception that anxiety is an aspect they can control. Consequently, this leads to a reduction in anxiety levels.[1,11]

In terms of anxiety reduction, PMR can have additional benefits, including increased self-confidence, enhanced concentration, and improved sleep quality through its relaxation effects.[9,11,14,16,17] Ebrahimi et al. (2022) found that the use of PMR in athletes with anxiety disorders helped calm disruptive thoughts, which indirectly contributed to increased self-confidence.[11] This finding aligns with a study by Liang et al. (2021), which stated that athletes with lower anxiety levels tend to exhibit higher self-confidence.[17] Furthermore, PMR exercises can help athletes regain focus and concentration by directing attention to the body and mind during training sessions.[9,16]

In addition to its role as a stress management technique, PMR can assist athletes in recovery after competition. Post-competition recovery is crucial to prevent fatigue and optimize performance in subsequent events. Relaxation techniques for recovery can reduce lactate levels in the blood and muscles, as lactate is a by-product that can impede movement and muscle coordination, leading to early fatigue.[24] Additionally, from a psychological perspective, PMR helps reduce stress and promotes relaxation, enabling athletes to face future competitions with optimal physical and mental conditions.[1,24]

The findings of PMR's effectiveness in reducing anxiety in athletes can be generalized to other populations, such as individuals in high-stress work environments, students preparing for exams, or individuals suffering from generalized anxiety disorder. Since PMR is a simple, non-invasive, and cost-effective intervention, it holds potential for broader application across various fields where stress and anxiety are prevalent. However, the extent of its effectiveness may vary depending on the individual's ability to engage in relaxation techniques and the context in which it is applied.

The use of PMR has significant implications for the management of anxiety, particularly in athletic settings. It can be incorporated into mental health programs to improve athletes' psychological resilience, enhance their performance, and support their overall well-being. Moreover, PMR could be integrated into broader wellness initiatives, helping individuals manage stress professionally and personally. Further, given its effectiveness in improving self-confidence and concentration, PMR can be a valuable tool in enhancing cognitive performance and mental clarity.

Despite its benefits, there are limitations to the application of PMR. First, the success of PMR depends mainly on the individual's willingness and ability to practice the technique regularly. For some individuals, particularly those with severe anxiety, learning to relax the muscles and regulate the body's physiological responses may take time and require additional therapeutic support. Furthermore, the impact of PMR may be temporary if not combined with other long-term anxiety management strategies. The studies reviewed primarily focused on athletes, and while the results are promising, the generalizability to different groups, such as individuals with chronic anxiety or those in high-pressure occupations, requires further research. Additionally, future studies could investigate the long-term effects of PMR on mental health, particularly regarding its ability to prevent anxiety from recurring.

Conclusion

This evaluation of PMR interventions across various athletic disciplines reveals positive outcomes, suggesting its applicability in athlete training programs. Most studies reported a statistically significant reduction in anxiety among those undergoing PMR compared to control or alternative groups. PMR has proven effective in reducing anxiety, enhancing self-confidence, improving concentration, addressing sleep disturbances, and facilitating post-competition recovery. It is beneficial for stress management and improving physical condition, contributing to optimal athletic performance.

However, some studies showed limited effectiveness, likely due to short intervention durations and small sample sizes, affecting the results' generalizability. Furthermore, measurement tools in some studies were not sufficiently

specific for sports-related anxiety, and participant characteristics, such as a limited age range and competition experience, also restricted broader applicability.

When compared to interventions like Autogenic Relaxation (AGR), Mental Imagery (MI), Imagery Exercises (IE), and citrus essential oil inhalation, PMR generally did not show a significant advantage. Each intervention has unique benefits, and their effectiveness can vary depending on individual factors, such as experience, mental readiness, and personal preference.

Overall, PMR is recommended as part of a mental training program to help athletes manage anxiety and enhance psychological readiness. Its effectiveness depends on the quality of the intervention design, training frequency, and measurement methods. Future research with more rigorous methodologies, diverse athlete populations, and combinations with other interventions is needed to validate its benefits further.

In conclusion, PMR is a practical, non-pharmacological intervention for reducing anxiety in athletes, supporting its use in mental training programs for competition preparation and post-competition recovery. Tailoring the intervention to individual characteristics can improve its effectiveness and enhance athletic performance.

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References

1. Battaglini MP, Pessôa Filho DM, Calais SL, Miyazaki MCOS, Neiva CM, Espada MC, et al. Analysis of Progressive Muscle Relaxation on Psychophysiological Variables in Basketball Athletes. Int J Environ Res Public Health. 2022 Dec 19;19(24):17065.
2. Dhiman C, Kapri BC. Optimizing Para-Athlete Well-Being: A Comprehensive Review and Meta-Analysis of Progressive Muscle Relaxation Interventions. J Epidemiol Public Health. 2024;2(3):1–8.
3. World Health Organization. Mental health of adolescents [Internet]. 2024 [cited 2025 Apr 26]. Available from: https://www.who.int/news-room/fact-sheets/detail/adolescent-mental-health
4. Kruger A. The prevalence of mental health and psychosocial concerns among South African student-athletes. J Affect Disord Rep. 2025 Apr;20:100888.
5. Åkesdotter C, Kenttä G, Eloranta S, Franck J. The prevalence of mental health problems in elite athletes. J Sci Med Sport. 2020 Apr;23(4):329–35.
6. Jermaina N, Kusmaedi N, Mamun A, Gaffar V, Purnomo E, Marheni E. Effects of relaxation exercises to reduce anxiety in beginner athletes. J Hum Sport Exerc. 2022 Dec;10(6):1275–83.
7. Thomas J, Mathew L. Effectiveness of Jacobson Progressive Relaxation, Acceptance and Commitment Therapy and Cognitive Behavioral Therapy on stress, anxiety, and quality of life in mothers of differently abled children: A quasi-experimental study. Int J Sci Healthc Res. 2023 Apr 7;8(2):1–16.
8. Syisnawati S, Keliat BA, Putri YSE. Effectiveness of progressive muscle relaxation therapy on anxiety by using a model approach, stress adaptation, and interpersonal. Malays J Med Health Sci. 2022;18(3):141–6.
9. Purnomo E, Sari SN, Marheni E. The influence of progressive muscle relaxation exercises on the level of anxiety in an athlete in the high jump. In: Proceedings of the 1st International Conference on Sport Sciences, Health and Tourism (ICSSHT 2019). Paris: Atlantis Press; 2021. p. 95–9.
10. Jannah M, Widohardhono R, Kencana NT. Progressive muscle relaxation: Can it reduce competitive anxiety? Phys Educ Theory Methodol. 2023 Oct 30;23(5):662–7.
11. Ebrahimi S, Agdasi MT, Mokaberian M. Analysis of the effect of inhaling orange essential oil on self-confidence and competitive anxiety of female athletes compared with relaxation. Int J Health Stud. 2022;8(3):24–9.
12. Abdelkhalek W, Mohamed E, Ibrahim A, Elmetwaly A. Effect of Jacobson's relaxation technique on anxiety and sleep quality in burn patients. Int Egypt J Nurs Sci Res. 2023 Jul 4;4(1):166–81.
13. Oladejo EM. Relaxation techniques on athletes' performance in sports: An overview. J Cap Dev Behav Sci. 2021;9(2):44–63.
14. Tahir H, Iqbal Y, Tabassum MF, Parveen S, Mushtaq T. Impact of anxiety on performance of Taekwondo athletes through progressive muscle relaxation training. Webology. 2021;18(6):6949–61.
15. Loh EW, Shih HF, Lin CK, Huang TW. Effect of progressive muscle relaxation on postoperative pain, fatigue, and vital signs in patients with head and neck cancers: A randomized controlled trial. Patient Educ Couns. 2022 Jul;105(7):2151–7.
16. Burhan Z, Vandita LY. The effect of imagery exercise and progressive muscle relaxation on anxiety and concentration in soccer athletes. Prisma Sains. 2021 Dec 30;9(2):220.
17. Liang D, Chen S, Zhang W, Xu K, Li Y, Li D, et al. Investigation of a progressive relaxation training intervention on precompetition anxiety and sports performance among collegiate student athletes. Front Psychol. 2021 Mar 17;11:624194.
18. Nien JT, Gill DL, Chou TY, Liu CS, Geng X, Hung TM, et al. Effect of brief mindfulness and relaxation inductions on anxiety, affect and brain activation in athletes. Psychol Sport Exerc. 2023 Jul;67:102422.
19. Anthoni J, Subanandhini S. Effectiveness of progressive muscle relaxation techniques on depression, anxiety and stress among undergraduate physiotherapy students: A quasi experimental study. Paripex Indian J Res. 2022 Sep 15;11(9):35–7.
20. Mashhadi-Naser S, Shirvani S, Vasli P. A randomized controlled trial to evaluate the progressive muscle relaxation technique in hip fracture patients. Sci Rep. 2024 Jun 12;14(1):13534.

21. K RP, Rajandekar T, Soundarya B. The effectiveness of progressive muscle relaxation and high intensity training on depression and quality of life in college students with polycystic ovarian syndrome. Int J Reprod Contracept Obstet Gynecol. 2021 Sep 27;10(10):3880–5.
22. Alnaimat S, Abu Safiyah Y, Mousa Jaber B. The effect of Jacobson's progressive muscle relaxation method on the competitive anxiety level of Jordanian Muay Thai athletes. Int J Psychosoc Rehabil. 2024;28(2):12–7.
23. Ihsan M, Sari LPMM, Wijaya TF, Saputri DM. The effectiveness of progressive muscle relaxation in reducing anxiety and sleep disturbances in hospitalized COVID-19 patients: A narrative review. Phys Ther J Indones. 2021 Dec 2;2(2):36–40.
24. Irham, Hidayat R, Anuar AB, Riswanto AH, Tunru AA. The effect of progressive relaxation techniques on anxiety of Bua Raga FC Sepak Takraw athletes: Before and during the match. J Phys Educ Sport Health Recreat. 2024;13(1):17–24.
25. Perakam S, Devpura G, Kondapalli A. The effect of Jacobson's progressive muscle relaxation technique on depression in diabesity patients. Int J Health Sci Res. 2020;9(3):34–41.