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The Effectiveness of Progressive Muscle Relaxation in Enhancing Athletes' Concentration: A Systematic Review

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Abstract

Background: Concentration is essential in individual and team sports and crucial to success. Athletes require high levels of focus in competitive environments. Those with good concentration perform optimally, while those struggling with focus may encounter difficulties during competitions. Current training programs often emphasize physical conditioning, technique, and tactics, while mental health training remains underexplored, including strategies to enhance concentration. One effective intervention for improving concentration is relaxation, particularly Progressive Muscle Relaxation (PMR), which combines muscle contraction and relaxation across different body regions. This study aims to analyze the effectiveness of PMR in enhancing athletes' concentration.

Methods: This study employs a Systematic Literature Review approach. Articles were retrieved from Google Scholar, PubMed, and Semantic Scholar using the PICO framework: "Athlete" AND "Progressive Muscle Relaxation OR Jacobson's Progressive Muscle Relaxation" AND "Concentration." Articles were selected based on inclusion and exclusion criteria. The risk of bias was assessed using the PEDro Scale, and findings were synthesized using narrative synthesis.

Results: A total of 839 articles were identified, with five meeting the final selection criteria. The studies reviewed indicate that PMR effectively enhances athletes' concentration.

Conclusion: PMR significantly improves concentration and may be considered an integral part of mental training programs for athletes. Improved concentration enhances decision-making efficiency and reduces errors during competitions. Individual factors, such as stress levels and prior experience, should be considered when implementing PMR.

Keywords: Progressive Muscle Relaxation, Concentration, Athlete

Introduction

Concentration is crucial to daily activities, including work, study, and sports. High concentration levels enable individuals to perform tasks effectively. In sports, concentration is a key mental factor contributing to success and achievement in competitions. The ability to control concentration and attention indicates mental health, enhancing psychological resilience and optimal performance in athletes.[1] Concentration is the ability to focus attention and awareness on a task without being distracted by internal or external stimuli.[2] Athletes require high levels of concentration in competitive environments. Other factors, such as physical, psychological, and mental aspects, also influence athletic performance.[3]

Concentration is essential across all sports, whether individual or team-based. For example, archery requires athletes to focus on a single target, while football relies on technical and tactical execution to score goals.[4,5] Athletes with good concentration perform optimally, whereas those struggling with focus may face difficulties during competitions. Disruptions in concentration can occur both in training and competition, leading to mistakes and missed opportunities.[5]

Athletes are prone to concentration disturbances due to internal and external factors. Internal factors include emotional disturbances such as anxiety, fear of failure, worry about results, and psychological pressure, while external factors involve environmental distractions.[6,7] These disturbances can cause an imbalance between strategic focus and emotional regulation, making athletes lose momentum. A study by Luthfi et al. (2024) found that stress and concentration disturbances increase the risk of injury due to athletes' inability to anticipate opponents' movements.[8] Concentration plays a role in problem-solving and decision-making, closely linked to working memory, which temporarily stores and processes new information.[9] If an athlete experiences distractions such as anxiety, stress, or depression, their ability to make decisions or solve problems may be impaired.[10]

Therefore, concentration is a critical factor in athletic performance. Several factors influence an athlete's performance, including physical, technical, and psychological (mental) training.[5] Achieving sports excellence requires more than physical, technical, and tactical training—it also demands mental preparation as a foundational element in an athlete's development.[11] The intense competition in sports often leads to excessive anxiety, negatively affecting performance. According to the cognitive-emotional interaction theory, emotional disturbances such as anxiety and

depression significantly impact cognitive abilities, including concentration.[12] Anxiety disrupts concentration and causes muscle tension, fatigue, and coordination difficulties, further impairing performance.[13]

One effective intervention for improving athletes' concentration is relaxation, particularly Progressive Muscle Relaxation (PMR).[3] PMR is categorized as both a mental training and physical relaxation technique aimed at enhancing concentration while reducing distress and negative emotions such as depression, anxiety, and stress.[14,15] This technique involves sequential muscle contraction and relaxation. PMR can be performed in a seated or supine position for 15–20 minutes, engaging all body parts from the face to the toes. The technique consists of muscle contraction for 7–10 seconds followed by relaxation for 15–20 seconds, repeated three times per muscle group. Simple equipment, such as a chair with back support, may be used.[16]

The physiological mechanism of PMR involves reducing sympathetic nervous system activity while increasing parasympathetic nervous system activity. The parasympathetic system counteracts the sympathetic response by slowing down bodily functions, including heart rate, breathing rhythm, muscle tension, blood pressure, metabolism, and stress hormone production. This results in reduced symptoms of depression, anxiety, and stress.[17] Consequently, the body achieves homeostasis, optimizing working memory function and improving concentration.[10,18] A study by Palekar et al. (2023) involving 30 archery athletes demonstrated that PMR effectively enhances concentration through emotional regulation.[19] Additionally, research by Jaworska et al. (2015) on 32 football players found that PMR improved running distance in the Cooper Test ($p = 0.04$), indicating enhanced focus and reaction time.[20] Five psychological factors influence an athlete's mental state: consistency, confidence, concentration, anxiety, and a positive attitude.[5]

However, current training programs often emphasize physical, technical, and tactical preparation while neglecting mental health development. Psychological training, particularly for concentration, is essential for optimizing athletic performance. Although various relaxation techniques have been applied in sports, systematic reviews evaluating PMR's effectiveness in improving athletes' concentration remain limited. Previous studies primarily focused on PMR's general benefits in reducing stress and anxiety-related disorders, which indirectly enhance performance, but did not specifically assess its impact on concentration.

Therefore, based on available scientific evidence, this study aims to systematically evaluate the effectiveness of Progressive Muscle Relaxation (PMR) in enhancing athletes' concentration. As healthcare professionals, physiotherapists should provide holistic interventions that address both physical and mental health. This need for further exploration motivates the present study, "The Effectiveness of Progressive Muscle Relaxation in Enhancing Athletes' Concentration: A Systematic Review."

Methods

The research method used in this study is a Systematic Literature Review (SLR). This method involves collecting articles through internet searches based on predetermined criteria. The software used for article searches is Publish or Perish, utilizing databases such as PubMed, Google Scholar, and Semantic Scholar. The search process follows the PICO framework for systematic mapping. This study focuses only on fully published (full-text) literature, including peer-reviewed journals and open-access publications available in databases. The risk of bias is assessed using the PEDro Scale. The independent variable in this study is Progressive Muscle Relaxation (PMR), while the dependent variable is concentration level.

The inclusion criteria for this study are as follows: (1) athletes as research subjects, (2) interventions involving Progressive Muscle Relaxation (PMR), (3) measurement of concentration levels, (4) articles published within the last five years (2020–2025), (5) articles written in English, and (6) study designs including mixed-methods studies, experimental studies, survey studies, cross-sectional studies, correlation analyses, comparative studies, and qualitative studies. This study focuses on the effectiveness of PMR in enhancing athletes' concentration without restricting the type of sport. Articles incorporating PMR alongside other methods are included; however, if the effects of PMR cannot be isolated or applied to a distinct group, such articles will be excluded.

The exclusion criteria are as follows: (1) studies involving subjects other than athletes, (2) interventions other than PMR, (3) studies that do not measure concentration levels, (4) articles published before 2020, (5) articles written in languages other than English, (6) systematic or literature review studies, and (7) articles with a PEDro Scale score of ≤3, indicating poor quality.

The 2020–2025 publication range selection ensures that the study reflects the latest research trends relevant to PMR interventions and concentration measurement techniques. The language restriction is based on the prevalence of English-language literature in sports science and physiotherapy, ensuring a broad and reliable source base. However, this limitation may exclude significant findings from non-English studies. To mitigate this, the study relies on reputable journal sources. The article selection process follows the PICO framework, as outlined below:

Table 1. The PICO framework

Framework	Keywords
Population	Athlete
Intervention	Progressive Muscle Relaxation
Comparison	Not applicable
Outcome	Concentration level

The SLR process consists of four main stages: identification, screening, data extraction, and analysis. The literature search was conducted online using the PICO framework, with one reviewer performing the database searches using PubMed, Google Scholar, and Semantic Scholar. Based on the PICO framework, the search keywords include "Athlete," "Progressive Muscle Relaxation OR Jacobson's Progressive Muscle Relaxation," AND "Concentration."

The latest search was conducted on February 15, 2025, yielding 839 articles. Articles are initially screened based on their titles and abstracts, followed by further selection based on inclusion and exclusion criteria. After selection, data extraction is performed using narrative synthesis, comparing and summarizing findings from different studies without conducting a combined statistical analysis. The extracted aspects include the intervention process, concentration measurement methods, study results, and methodological quality. The final analysis is reported using PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses), mapping the study flow into identification, screening, eligibility, and inclusion stages.

The article selection process was conducted based on the keywords outlined in the PICO framework, which included "athlete," "Progressive Muscle Relaxation," and "concentration." A database search using these keywords across PubMed, Google Scholar, and Semantic Scholar yielded 839 articles. After 19 duplicate articles were removed, 820 articles remained. The selection process continued by screening titles and abstracts, narrowing the selection to 20 articles. Subsequently, seven articles were excluded for not meeting the inclusion criteria, such as publication year discrepancies and participant mismatch, leaving 13 articles. An additional eight articles were excluded due to their lack of relevance to the research objectives or because they were literature reviews, resulting in 5 articles for final analysis using narrative synthesis. The data extraction process is reported following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA), and the article selection process is illustrated in Figure 1.

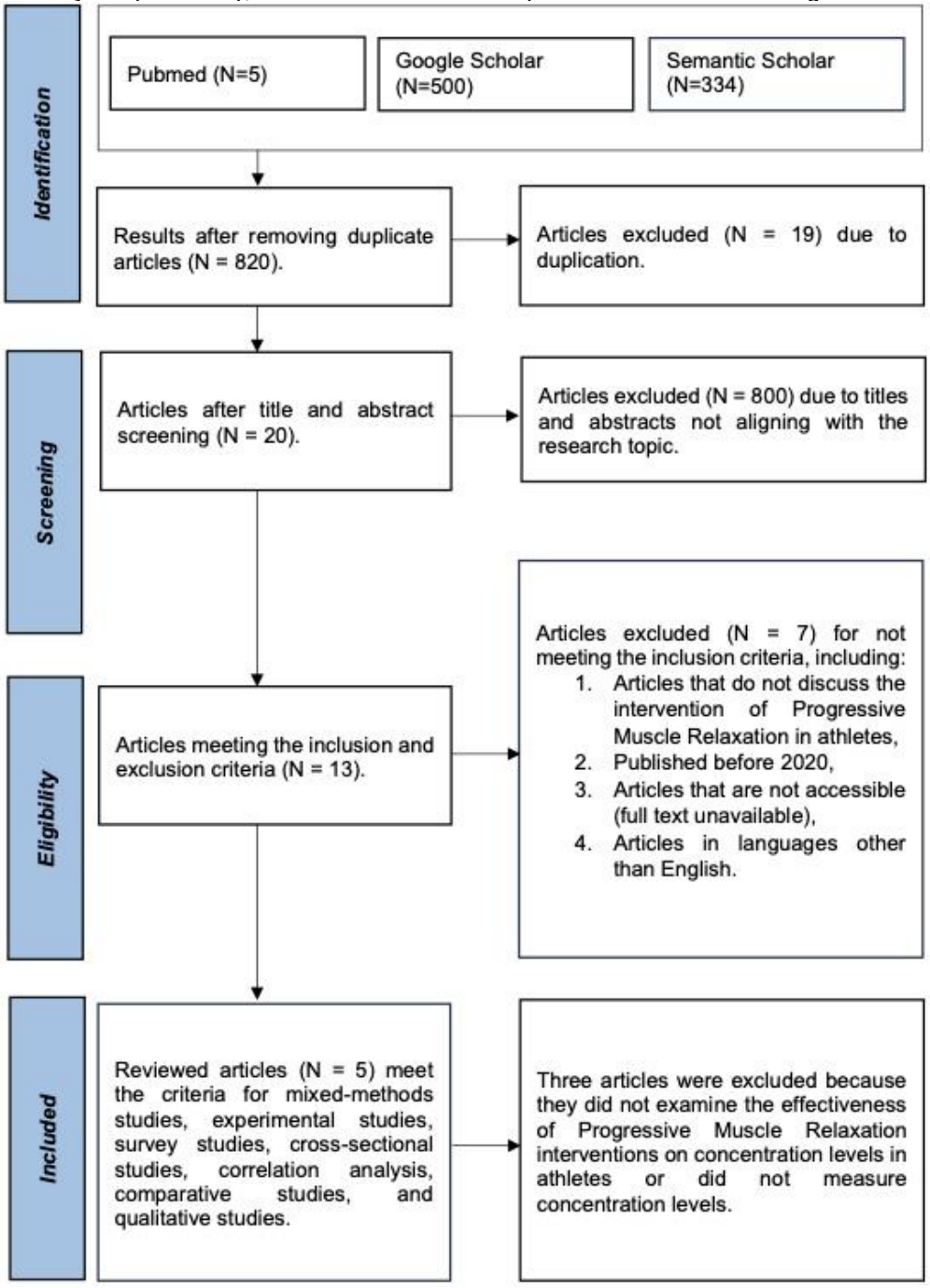

Figure 1. PRISMA Flow Diagram

The selected articles undergo a quality assessment using the PEDro Scale. The Physiotherapy Evidence Database (PEDro) evaluates the methodological quality of studies in the systematic literature review in physiotherapy and health sciences. Assessing study quality is essential to minimize bias and ensure the reliability of research findings. The results of the PEDro Scale evaluation are presented in Table 2.

Table 2. Results of PEDro Scale Assessment

No	Study	Verawati et al., 2020	Burhan dan Vandita, 2021	Palekar et al., 2023	Novan et al., 2021	Afifuddin et al., 2020
1	Eligibility criteria	✓	✓	✓	✓	✓
2	Random allocation	✓	✓	✓	✓	✓
3	Concealed allocation	X	X	X	X	X
4	Baseline comparability	✓	✓	✓	✓	✓
5	Blinding of subjects	X	X	X	X	X
6	Blinding of therapists	X	X	X	X	X
7	Blinding of assessors	X	X	X	X	X
8	Adequate follow-up	✓	✓	✓	✓	✓
9	Intention-to-treat analysis	X	X	X	X	X
10	Between-group comparisons	✓	✓	✓	✓	✓
11	Point measures & variability data	✓	✓	✓	✓	✓
Total		5	5	5	5	5
Quality		Average	Average	Average	Average	Average

All articles assessed using the PEDro Scale demonstrated moderate methodological quality. These five articles were all indexed in international databases. Based on the PEDro Scale analysis, the reviewed studies exhibited a relatively high risk of bias due to the absence of concealed allocation, participant and assessor blinding, and intention-to-treat analysis. These factors could introduce selection bias, reducing the validity of group comparisons and increasing information bias, ultimately affecting research outcomes' objectivity. Although all studies employed valid measurement tools, the lack of bias control makes it difficult to confirm the effectiveness of Progressive Muscle Relaxation (PMR) in enhancing athletes' concentration. Therefore, further research with more rigorous methodologies—such as improved randomization, blinding, and intention-to-treat analysis—is necessary to ensure that the effects of PMR on concentration are genuinely attributable to the intervention rather than other factors.

Despite methodological limitations, including the absence of blinding procedures, concealed allocation, and intention-to-treat analysis, the reviewed studies still possess several strengths. All studies implemented clear participant criteria and randomized allocation, ensuring baseline equivalence between groups. Additionally, they conducted adequate follow-ups, compared results across groups, and presented data with effect sizes and variability measures. Consequently, although there is a risk of bias, the findings provide valuable insights and serve as a foundation for future research. A summary of the reviewed articles is presented in Table 3.

Table 3. Summary of Study Results

No	Study	Research Method (Design, Sample, Duration of Intervention)	Research Parameter	Group	Average Concentration Score	Concentration Improvement (P-Value)
1	Verawati et al., 2020	D: Experimental pretest-posttest control group design S: 12 archery athletes from UNIMED club DI: Not explicitly stated	Grid Concentration Test	Intervention	16	21.67
				Control	16	16.33
2	Burhan & Vandita, 2021	D: Quasi-experimental S: 33 soccer athletes DI: Not explicitly stated	Grid Concentration Test	Intervention	Not explicitly stated in the article	P = 0.000 (Highly significant)
				Control	Not explicitly stated in the article	P = 0.171 (Not significant)
3	Palekar et al., 2023	D: Experimental pretest-posttest control group design S: 30 archery athletes DI: 6 weeks, 6 sessions per week	Shooting performance	Intervention	54.55	57.17
				Control	54.79	54.24
4	Novan et al., 2021	D: Quasi-experimental with non-equivalent control group design S: 12 shooting athletes DI: 6 weeks, 3 sessions per week	Grid Concentration Test	Intervention	15.83	25.33
				Control	16.33	18.17
5	Afifuddin et al., 2020	D: Experimental factorial 2x2 design S: 20 basketball athletes DI: 12 sessions	Grid Concentration Test and Free Throw Shooting	Intervention (low concentration athletes)	2.8	5
				Intervention (high concentration athletes)	4.4	7.2

Based on the research findings in Table 3, all studies indicate that Progressive Muscle Relaxation (PMR) positively affects athletes' concentration or performance, although the level of significance varies. The increase in concentration scores in the intervention group was generally more significant than in the control group, with some studies showing highly significant differences ($P < 0.0001$). In contrast, others reported minor but substantial improvements ($P = 0.015$ or $P = 0.028$). However, some studies did not explicitly report concentration scores but presented significant

results. Overall, these findings support the effectiveness of Progressive Muscle Relaxation in enhancing athletes' concentration compared to the control group.

Discussion

After completing the screening process, five articles were selected for analysis using the narrative synthesis method. This method was chosen to compare findings across studies and identify factors contributing to differences in results. The five articles share a common research objective: enhancing athletic performance by assessing concentration levels.

A study by Verawati et al. (2020) implemented Progressive Muscle Relaxation (PMR) on archery athletes using an experimental pretest-posttest control group design. Concentration was assessed using the Grid Concentration Test (GCT). The intervention lasted approximately 10 minutes and was administered after routine training sessions. The findings indicated that the experimental group experienced a significant increase in concentration scores by 5.67 points, with an average rising from 16 to 21.67 ($p < 0.05$). In contrast, the control group, which received no intervention, showed a slight increase of 0.33 points, averaging 16 to 16.33. The study demonstrated that PMR significantly enhances concentration by helping athletes achieve an alpha state—a relaxed yet alert mental condition—thereby improving focus on tasks. These results support the theory that progressive muscle relaxation enhances attentional sharpness and concentration in sports requiring high precision, such as archery.[5]

Burhan and Vandita (2021) investigated the effects of PMR on football players using a quasi-experimental design (matching-only design). Concentration was measured with the Grid Concentration Test (GCT). A t-test analysis in the intervention group revealed a significant improvement in concentration (Sig. (2-tailed) = 0.000, $p < 0.05$). Meanwhile, the control group underwent conventional training and showed non-significant results ($p = 0.171$). This study only reported statistical significance without explicitly detailing the differences between pretest and posttest concentration scores. Besides enhancing concentration, PMR enables athletes to refocus their attention on specific tasks, a crucial aspect in football, which requires quick decision-making and effective movement coordination.[4]

Palekar et al. (2023) conducted a study on archery athletes, applying PMR for six weeks at a frequency of six weekly sessions. The research employed an experimental pretest-posttest control group design, measuring concentration through shooting performance. The results demonstrated a highly significant improvement in shooting performance ($p < 0.0001$). The study attributed PMR's effectiveness in improving concentration to its significant anxiety-reducing effect ($p = 0.017$) before competitions, enhancing attention control. Consequently, these findings suggest that PMR is an effective method for enhancing athlete concentration through emotional regulation, positively impacting competition performance.[19] Aligning with these results, a study by Jun et al. (2023) found that PMR reduces competitive anxiety, leading to more stable concentration. This improvement is due to autonomic nervous system regulation, reducing sympathetic nervous system activity while enhancing respiratory control, allowing athletes to maintain focus longer and execute techniques more precisely.[21]

Novan et al. (2021) applied PMR to 10-meter shooting athletes over six weeks, with sessions thrice weekly. Using a quasi-experimental non-equivalent control group design, concentration was measured using the Grid Concentration Test (GCT). The findings showed a significant improvement in concentration scores in the experimental group compared to the control group. Additionally, the study assessed shooting performance, verifying that increased concentration levels enhanced shooting accuracy ($p < 0.05$).[1]

Afifuddin et al. (2020) examined PMR in basketball athletes over 12 sessions, utilizing an experimental factorial 2x2 design. Participants were divided into two intervention groups—PMR and autogenic relaxation—each further categorized into high-concentration and low-concentration subgroups. The Grid Concentration Test (GCT) was used for participant selection, while free throw shooting performance was the study's outcome measure. Results indicated that both high- and low-concentration PMR groups exhibited significant improvements in free throw accuracy, demonstrating that PMR enhances concentration by improving motor control necessary for precise execution.[22]

Based on the synthesis of these studies, PMR influences athletic performance by increasing concentration and reducing anxiety levels. Improved concentration enhances movement coordination and control required for execution. These findings provide a foundation for developing more effective mental and physical training programs to strengthen athlete concentration through PMR interventions.

This study did not conduct a meta-analysis due to limited studies investigating PMR's effectiveness on concentration and methodological variations across studies. Differences in intervention duration and concentration assessment parameters made meta-analysis unsuitable, as it could yield inaccurate data. Therefore, a narrative synthesis approach was used to compare study findings and identify contributing factors to result variations.

The synthesis identified study limitations, including inconsistent control measures, varied assessment methods, and differences in PMR duration and frequency, making direct comparisons challenging. The limited research on PMR's effectiveness in improving athlete concentration constrains this study. Additionally, publication bias may occur, as studies with significant effects are more likely to be published. Consequently, further research with more rigorous methodologies and transparency in reporting results is needed to ensure conclusions accurately reflect PMR's effects. This study was not registered, as it is an exploratory review of PMR's effectiveness in enhancing athlete concentration based on available literature. It aims to provide an initial overview of published findings.

Overview of Progressive Muscle Relaxation in Enhancing Concentration

Progressive Muscle Relaxation (PMR) is a relaxation technique that combines muscle contraction and relaxation. It can be performed in a seated or supine position. The intervention begins with deep breathing, followed by muscle contraction (7-10 seconds) and relaxation (15-20 seconds), repeated three times with equal intervals across all muscle groups.[16] PMR aims to enhance concentration, improve sleep quality, lower blood pressure, reduce muscle

tension, and alleviate mental distress, including depression, anxiety, and stress.[23] Physiologically, concentration is essential for problem-solving and is closely linked to working memory function. Working memory temporarily stores and processes new information while integrating it with prior knowledge.[9] The dorsolateral prefrontal cortex is the primary area involved in working memory. This process begins when stimuli—such as visual, auditory, and sensory inputs—are transmitted to the central executive (prefrontal cortex), where attention is directed toward relevant new information. The information is then stored and processed alongside long-term memory, aiding decision-making and problem-solving.[10]

Mental distress is a key factor contributing to concentration difficulties. Athletes struggling with concentration face challenges in processing information.[24] Optimal concentration requires integrating new information with long-term memory, including perceptual, autobiographical, linguistic, semantic, visual, declarative, and motor skill memories.[10] When alignment between new information and past experiences occurs, athletes can make accurate decisions. However, if negative emotions interfere, concentration may be disrupted due to hyperactivity in the prefrontal cortex, crucial in managing relevant new information.[18]

PMR's physiological mechanism reduces sympathetic nervous system activity and enhances parasympathetic nervous system function. Increased parasympathetic activation slows organ functions, including lowering heart rate, respiratory rhythm, muscle tension, blood pressure, metabolism, and stress hormone production.[19,25] This regulation restores balance in prefrontal cortex activity, reducing stress and anxiety while promoting a state of calm. A relaxed body enhances focus and concentration, enabling athletes to maintain attention effectively during competitions.[21] A study by Amutha & Vakkil (2024) demonstrated that relaxation exercises like PMR improve student focus during mathematics exams.[26] This suggests that PMR's concentration-enhancing effects extend beyond sports.

Athlete concentration levels significantly influence performance. High concentration enables athletes to remain focused on tasks without being distracted by external or internal factors.[27] According to the OPTIMAL (Optimizing Performance Through Intrinsic Motivation and Attention for Learning) theory, attentional control is critical in enhancing concentration through increased performance expectations, support for individual autonomy, and external attentional focus. A study by Wulf & Lewthwaite (2021) found that external focus and high motivation improve motor coordination, postural stability, and movement efficiency in sports.[28]

Optimal attentional control enhances athletic performance by improving decision-making efficiency, reducing cognitive load, and minimizing errors during competitions. Additionally, high concentration levels enable quicker reactions and greater accuracy in motor skills.[29] Physiologically, attentional control is closely associated with optimal activation of the prefrontal cortex, which governs executive functions such as focus, decision-making, and motor control.[18] Concentration, as a psychological factor, helps reduce stress hormone levels and cognitive load, promoting a calm yet alert state and allowing athletes to maintain focus and achieve optimal performance during competitions.[30,31]

Conclusion

Based on the results and discussion of the five articles examining the effects of Progressive Muscle Relaxation (PMR) on concentration levels, it can be concluded that PMR has the potential to enhance concentration in athletes. However, further research is needed to strengthen these findings. Additionally, PMR can reduce emotional disturbances such as anxiety, depression, and stress, leading to a sense of calmness that supports improved concentration. This intervention can serve as a training option for athletes in mental health development, particularly enhancing concentration to improve athletic performance.

These findings align with previous research highlighting the benefits of PMR for concentration and mental well-being in athletes. PMR can be considered part of an athlete's mental training program, considering individual factors such as stress levels and prior experience with relaxation techniques.

This study has several limitations, including variations in measurement methods, differences in the duration and frequency of PMR, and a lack of control in the study design, making direct comparisons between results challenging. Furthermore, the limited number of studies explicitly investigating the effectiveness of PMR on concentration in athletes poses a constraint in drawing more substantial conclusions. Therefore, further research using more rigorous methodologies, such as randomized controlled trials (RCTs), is necessary to explore the long-term effectiveness of PMR and compare it with other relaxation techniques in enhancing athletes' concentration.

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