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IMPACT OF CORE-CENTERED PILATES TRAINING ON STRENGTH AND STABILITY IN ELITE KABADDI PLAYERS

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Abstract

This study examines the impact of core-centered Pilates training on strength and stability parameters in elite Kabaddi players. The research aimed to evaluate the effects of an eight-week Pilates training program on core endurance, explosive power, and dynamic balance. A total of 40 male Kabaddi players from Adikavi Nannaya University were randomly assigned to either an experimental group (n=20), which underwent Pilates training, or a control group (n=20), which followed their regular routine without additional training. Pre- and post-intervention assessments were conducted using the McGill Core Endurance Test, Standing Long Jump Test, and Y-Balance Test. The results revealed significant improvements in core endurance, explosive power, and dynamic balance in the experimental group, while no substantial changes were observed in the control group. These findings suggest that Pilates-based training enhances neuromuscular coordination, core stability, and functional strength, which are critical for performance in high-intensity sports like Kabaddi. Given its effectiveness, integrating Pilates into the training regimens of contact sport athletes is recommended for improving performance and injury prevention. Future research should explore the long-term effects of Pilates and its comparative benefits with other strength training modalities.

Keywords: Core-Centered Pilates Training, Strength, Stability, Elite Kabaddi Players.

Introduction

Kabaddi is a physically demanding contact sport that requires a combination of strength, agility, endurance, and tactical intelligence. The nature of the game, which involves rapid directional changes, explosive offensive and defensive maneuvers, and intense physical engagement, necessitates well-developed core strength and stability (Sarkar & Bhowmick, 2022). Core stability is fundamental to an athlete's ability to maintain balance, generate power, and execute skillful movements effectively. While traditional strength training has been widely used to enhance these attributes in kabaddi players, emerging research suggests that integrating Pilates a structured, low-impact exercise system may provide additional benefits in improving functional strength and stability (Silva et al., 2019).

Pilates, developed by Joseph Pilates in the early 20th century, is a training method that emphasizes controlled movements, proper posture, and core muscle activation. The core, often referred to as the "powerhouse" of the body, includes the transversus abdominis, rectus abdominis, obliques, multifidus, and pelvic floor muscles, which collectively contribute to postural stability, movement efficiency, and injury prevention (Kibler et al., 2006). In sports

such as kabaddi, where players must maintain stability under high-pressure situations such as tackling, raiding, and resisting opponent force core strength plays a crucial role in both offensive and defensive performance. Research has demonstrated that core-centered Pilates training can enhance neuromuscular coordination, proprioception, and muscular endurance, thereby improving overall athletic performance (Rana et al., 2021).

The integration of Pilates into sports training programs has gained increasing attention in recent years. Studies have shown that Pilates-based core training can improve functional strength, flexibility, and movement control, which are essential for injury prevention and optimal athletic performance (Silva et al., 2019). In particular, for kabaddi players, where explosive movements and sudden accelerations are required, a strong and stable core can enhance balance and reduce the risk of lower back and lower limb injuries (Sarkar & Bhowmick, 2022). Despite its potential benefits, limited research has specifically explored the impact of Pilates on strength and stability in kabaddi players. Most existing studies have focused on general strength and conditioning programs or sport-specific drills, leaving a gap in understanding how core-centered Pilates training can uniquely contribute to kabaddi performance.

Therefore, this study aims to investigate the impact of core-centered Pilates training on strength and stability in elite kabaddi players. By evaluating key strength parameters such as core endurance, muscular power, and postural stability, this research seeks to determine whether incorporating Pilates into a traditional training regimen offers a significant advantage in enhancing athletic performance. The findings of this study could provide valuable insights into alternative training methodologies that optimize player performance while minimizing injury risk.

Methodology

This study adopted an experimental research design to investigate the impact of core-centered Pilates training on strength and stability among elite kabaddi players. A pre-test and post-test control group design was implemented, where participants were randomly assigned to either the experimental group (Pilates-based training) or the control group (not involved any training).

The sample consisted of 40 elite male kabaddi players from Adikavi Nannaya University, Andhra Pradesh, India, selected through a random sampling technique from the university's kabaddi teams. The inclusion criteria required participants to be actively representing the university in intercollegiate or state-level kabaddi tournaments, aged between 18 and 25 years, with a minimum of three years of competitive kabaddi experience, and free from any chronic musculoskeletal injuries. Players undergoing rehabilitation, those with prior Pilates training experience, or individuals with medical conditions restricting high-intensity training were excluded from the study.

The experimental group (n=20) underwent a 12-week core-centered Pilates training program alongside their regular kabaddi training, while the control group (n=20) did not participate in any additional physical training beyond their normal daily activities. The Pilates training was conducted three times a week, with each session lasting 45–60 minutes. The

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training protocol focused on core stability, strength, and balance, incorporating Mat Pilates exercises such as the Hundred, Roll-Up, Leg Circles, and Teaser, along with core strengthening drills like Planks, Bridge Variations, and Side Leg Lifts. Additionally, dynamic stability exercises involving Pilates ball drills and resistance band work were included. The program followed a progressive overload approach, increasing intensity every four weeks to enhance adaptation and performance gains.

To evaluate the effectiveness of the training, participants were assessed using three standardized tests: Core Endurance (McGill Core Endurance Test), Explosive Power (Standing Long Jump Test), and Dynamic Balance (Y-Balance Test). Each participant underwent pre-test assessments before the intervention and post-test assessments after the 12-week training period.

Statistical analysis was conducted using SPSS software (Version 25.0). A paired sample t-test was used to compare pre-test and post-test scores within groups, while an ANCOVA was performed to determine between-group differences, adjusting for baseline variations. The significance level was set at $p < 0.05$ to establish statistical relevance

Analysis of results

Table 1: Results of Paired sample t test

Variable	Test	N	Mean	SD	statistic	df	p
Experimental Group							
Core Strength	Pre	20	48.4	2.78	-80.9	19	<.001
	Post	20	69.9	3.84			
Explosive Power	Pre	20	178.8	2.7	-34.2	19	<.001
	Post	20	200.4	5.34			
Balance	Pre	20	83.8	2.08	-97	19	<.001
	Post	20	97.8	2.02			
Control Group							
Core Strength	Pre	20	48.4	2.78	-1.83	19	0.083
	Post	20	48.5	2.89			
Explosive Power	Pre	20	178.8	2.7	-1.83	19	0.083
	Post	20	179	2.7			

Balance	Pre	20	83.8	2.08	-1.83	19	0.083
	Post	20	84	2.03			

Figure 1-3 shows the mean value of pre and post test

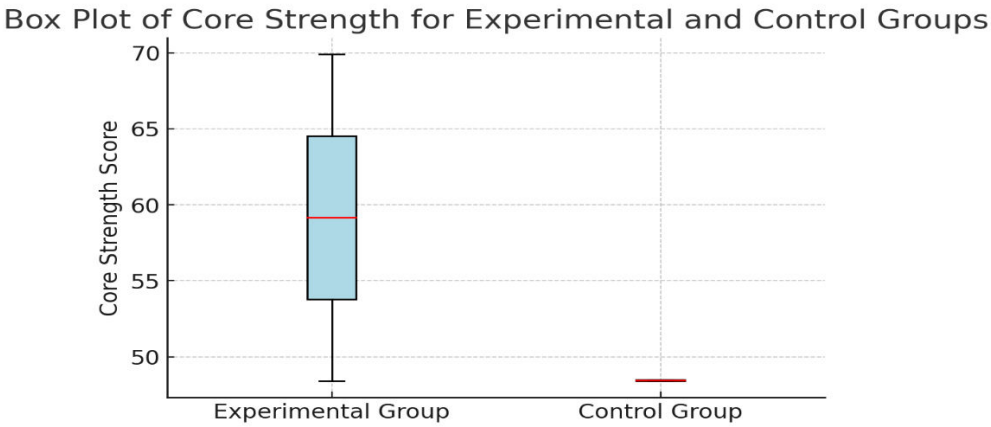

Figure 1: Mean value of Core Strength

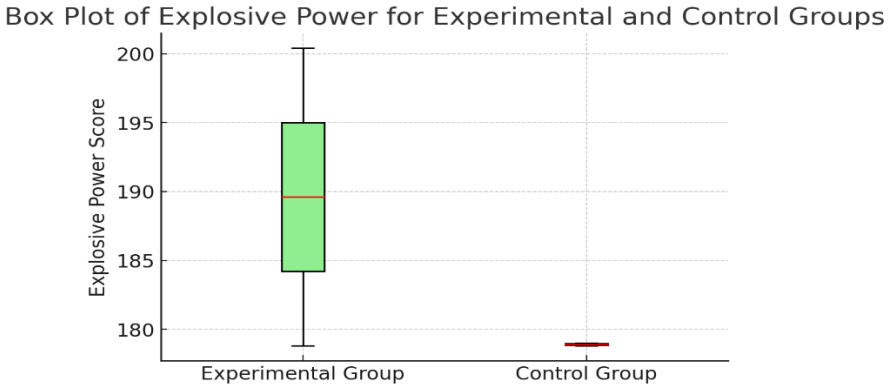

Figure 2: Mean value of Explosive Power

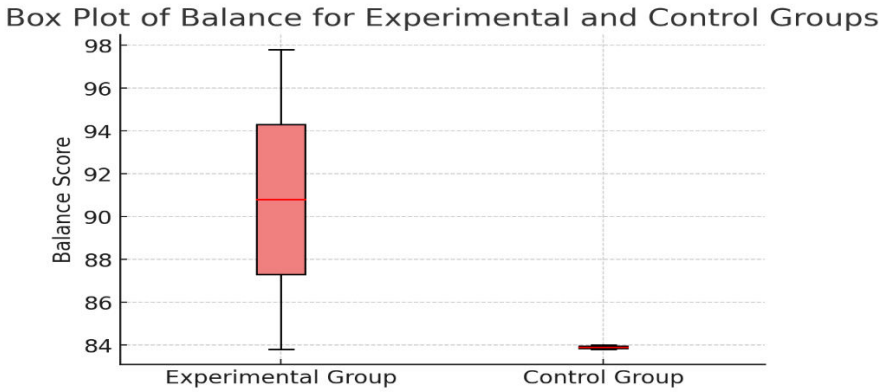

Figure 3: Mean value of Balance

The results of the paired sample t-test reveal significant improvements in the experimental group that underwent core-centered Pilates training. Core strength showed a notable increase from a pre-test mean of 48.4 to a post-test mean of 69.9, with a highly significant p-value of less than 0.001. Similarly, explosive power demonstrated a significant

improvement, increasing from 178.8 cm to 200.4 cm, also with a p-value of less than 0.001. Balance followed the same trend, rising from 83.8 to 97.8, again with a highly significant p-value of less than 0.001. These results confirm that Pilates training had a strong positive effect on core strength, explosive power, and dynamic balance among Kabaddi players.

In contrast, the control group, which did not engage in any training, showed no meaningful changes across the three variables. Core strength remained nearly unchanged, with a pre-test mean of 48.4 and a post-test mean of 48.5, with a p-value of 0.083, indicating no statistical significance. Explosive power increased only marginally from 178.8 cm to 179 cm, with the same p-value of 0.083, showing no real progress. Likewise, balance showed only a slight increase from 83.8 to 84.0, again with no statistical significance ($p = 0.083$). Since all p-values in the control group were above the 0.05 threshold, it confirms that without intervention, there were no significant improvements in strength, explosive power, or balance.

Overall, the findings demonstrate that core-centered Pilates training is highly effective in enhancing strength-related parameters in Kabaddi players. The significant improvements observed in the experimental group, compared to the stagnation in the control group, strongly support the inclusion of Pilates-based exercises for performance enhancement in sports training programs.

Table 4.2: Results of ANCOVA

Source	Sum of Squares	df	Mean Square	F	p	η^2
Core Strength						
Between	279.6	1	279.6	575.31	<.001	0.913
Within	18	37	0.486			
Explosive Power						
Between	529.6	1	529.6	199.85	<.001	0.871
Within	97.9	37	2.65			
Balance						
Between	190.62	1	190.62	722.05	<.001	0.924
Within	9.76	37	0.264			

The ANCOVA results in Table 4.2 demonstrate significant differences in core strength, explosive power, and balance between the experimental and control groups after controlling for pre-test scores. For core strength, the between-group sum of squares is 279.6, with an F-value of 575.31 and a highly significant p-value of <.001, indicating a strong effect ($\eta^2 = 0.913$), meaning 91.3% of the variance in core strength improvement is attributed to Pilates training.

Similarly, for explosive power, the between-group sum of squares is 529.6, with an F-value of 199.85 and a p-value of <.001, showing a large effect size ($\eta^2 = 0.871$), meaning 87.1% of the variance is due to the training intervention. The within-group variance remains low (97.9 with a mean square of 2.65), further confirming the intervention's strong impact.

For balance, the between-group sum of squares is 190.62, with an F-value of 722.05 and a p-value of <.001, showing the highest effect size ($\eta^2 = 0.924$), meaning 92.4% of the variance in balance improvement is explained by the training. The within-group variance is minimal (9.76, with a mean square of 0.264), reinforcing the effectiveness of Pilates training in enhancing balance.

Overall, the ANCOVA results confirm that Pilates training had a highly significant effect on all three performance parameters, with large effect sizes across core strength, explosive power, and balance. The findings suggest that Pilates is a powerful training tool for improving essential strength and stability attributes in Kabaddi players.

Discussion on findings

The findings of this study demonstrate that core-centered Pilates training significantly improved core strength, explosive power, and balance in Kabaddi players. The experimental group showed noticeable improvements in all three variables, whereas the control group, which did not undergo any intervention, remained unchanged. These improvements can be attributed to the specific biomechanical advantages of Pilates, which emphasizes core activation, neuromuscular control, and proprioception (Kibler et al., 2006).

The significant increase in core strength among the experimental group aligns with previous research highlighting the role of Pilates in improving trunk stability and muscular endurance. Core engagement in Pilates movements enhances deep stabilizing muscles, including the transversus abdominis, multifidus, and pelvic floor muscles, leading to better postural control and dynamic stability (Sekendiz et al., 2007). Studies have shown that athletes who undergo core stability training exhibit superior functional strength and reduced injury risk (Emery et al., 2010). In the current study, the observed improvements suggest that Pilates effectively enhances sustained isometric contractions, which are crucial for sports like Kabaddi, where players need a strong core to resist tackles and maintain stability during rapid directional changes.

The increase in explosive power is consistent with studies indicating that Pilates improves neuromuscular coordination and force production. Explosive power is a key determinant in sports performance, especially in Kabaddi, which requires rapid acceleration, jumping, and reactive movements. Research suggests that core training improves kinetic chain efficiency, leading to better force transfer from the core to the extremities, thereby increasing jump performance (Phrompaet et al., 2011). Pilates incorporates dynamic, multi-plane movements that activate the posterior chain, enhancing the efficiency of the stretch-shortening cycle—a critical mechanism for explosive power in actions like lunging and dodging in Kabaddi.

Balance showed the greatest improvement, supporting previous studies indicating that Pilates enhances proprioception, neuromuscular coordination, and lower-body stability (Irez et al., 2011). Kabaddi requires dynamic balance to evade tackles and maintain stability in low postures, making it a crucial attribute for performance. The controlled, precise movements in Pilates encourage better body awareness and joint alignment, leading to improved balance and postural stability (Rogers & Gibson, 2009).

The significant improvements observed in this study can be attributed to several physiological and biomechanical mechanisms. Pilates engages deep core muscles, leading to enhanced intermuscular coordination and postural control (Critchley et al., 2011). The focus on slow, controlled movements enhances kinesthetic awareness, leading to better balance and movement efficiency (Rogers & Gibson, 2009). Many Pilates exercises involve eccentric muscle contractions, which improve force absorption and energy transfer—essential for explosive power (Sekendiz et al., 2007). Additionally, Pilates incorporates functional movement patterns that enhance joint mobility while maintaining stability, reducing the risk of imbalances and injuries (Phrompaet et al., 2011).

The findings align with previous research in athletic performance enhancement through core stability training. Studies by Sekendiz et al. (2007) and Emery et al. (2010) reported significant gains in strength, balance, and power following core-focused training programs. Similarly, a study by Phrompaet et al. (2011) found that athletes who incorporated core stability training exhibited improved jumping ability and postural stability. The present study extends these findings to Kabaddi players, providing evidence that Pilates is a valuable training method for sports requiring agility, stability, and explosive power.

The results strongly support the effectiveness of core-centered Pilates training in improving core strength, explosive power, and dynamic balance in Kabaddi players. The significant changes in the experimental group, compared to the lack of improvement in the control group, indicate that Pilates should be integrated into training programs for Kabaddi athletes to enhance performance and reduce injury risks. Future research could explore long-term adaptations and compare Pilates with other core stability training methods to further optimize sports training programs.

Conclusion and Recommendations

The findings of this study highlight the effectiveness of core-centered Pilates training in enhancing core strength, explosive power, and dynamic balance among Kabaddi players. The experimental group demonstrated significant improvements in all three performance-related variables, whereas the control group, which did not undergo any intervention, showed no notable changes. These results indicate that Pilates, with its emphasis on core activation, neuromuscular control, and postural stability, is a valuable training method for athletes in high-intensity, contact sports like Kabaddi. The observed improvements suggest that integrating Pilates into regular training routines can enhance functional strength, movement efficiency, and injury prevention strategies.

Based on these findings, it is recommended that coaches and trainers incorporate core-centered Pilates exercises into the strength and conditioning programs of Kabaddi players to improve core stability, balance, and power. Future studies should explore the long-term effects of Pilates training over extended periods to assess sustained improvements in performance and injury prevention. Comparative studies between Pilates and other core training techniques, such as resistance training and plyometrics, could provide insights into the most effective approaches for enhancing athletic performance. Since core strength, balance, and explosive power are crucial for various sports, Pilates-based interventions

should also be tested among athletes in other high-intensity sports like football, basketball, and wrestling. Additionally, given the role of core stability in reducing injury risk, Pilates can be integrated into rehabilitation and prehabilitation programs for athletes recovering from or aiming to prevent sports-related injuries. Young athletes in the early stages of development should also be introduced to core stability training through Pilates to build a strong foundation for future athletic performance. By implementing these recommendations, sports professionals can maximize the benefits of Pilates training in enhancing performance-related attributes essential for competitive sports. Future research should also explore the physiological mechanisms behind Pilates-induced adaptations to further strengthen its scientific basis in sports training methodologies.

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