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Combined Effects of Kinesio Taping and Proprioceptive Neuromuscular Facilitation (PNF) Stretching on Hamstring Flexibility in Recreational Football Players

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I. INTRODUCTION

Hamstring flexibility is an important component of physical fitness and plays a crucial role in football performance, particularly in sprinting, kicking, and rapid changes of direction. Reduced hamstring flexibility may increase the risk of muscle strain and decrease athletic performance. Various interventions have been used to improve flexibility, including proprioceptive neuromuscular facilitation (PNF) stretching and Kinesio Taping (KT). Previous studies have reported that PNF stretching is effective in improving hamstring flexibility [1], while the application of Kinesio Taping, particularly when combined with other modalities, may further enhance muscle extensibility [2][3]. The reliability of hamstring flexibility assessment using the Active Knee Extension (AKE) test has also been well established [4].

Although both methods are commonly used in sports rehabilitation and conditioning, limited studies have investigated the combined effects of KT and PNF stretching on hamstring flexibility, particularly among recreational football players. Therefore, the purpose of this study was to examine the effects of PNF stretching and the combination of KT with PNF on hamstring flexibility compared to a control group.

II. METHODS

This study employed a pretest-posttest experimental design. A total of 12 male recreational football players aged between 18 and 25 years were recruited using purposive sampling and randomly assigned to three groups: PNF stretching, KT combined with PNF, and control. The intervention was conducted three times per week for four weeks. Hamstring flexibility was measured using the Active Knee Extension (AKE) test and the Sit-and-Reach test before and after the intervention period. Data were analysed using descriptive statistics and inferential analysis to determine within- and between-group differences.

III. RESULTS AND DISCUSSION

The Shapiro–Wilk test confirmed that the data were normally distributed ($p > .05$), satisfying the assumption of normality. A two-way repeated-measures ANOVA showed a significant effect of time on hamstring flexibility for both the Active Knee Extension (AKE) and Modified Sit-and-Reach tests ($p < .001$). Significant time $\times$ group interactions were also found for both measures (AKE: $p = .003$; Sit-and-Reach: $p < .001$), indicating that flexibility changes differed between groups. In addition, significant group differences were observed for both tests. Post hoc analysis (Bonferroni-adjusted) revealed that the KT+PNF group demonstrated significantly greater improvements compared to the Control group in both AKE and Sit-and-Reach performance. The KT+PNF group also showed greater improvement than the PNF group in the AKE test. No significant differences were found between the Control and PNF groups.

These results suggest that combining Kinesio Taping with PNF stretching leads to greater improvements in hamstring flexibility compared with stretching alone. The finding is consistent with previous studies reporting that PNF stretching significantly improves hamstring flexibility compared with conventional approaches [1] and that flexibility outcomes are further enhanced when Kinesio Taping is combined with stretching interventions [2]. The greater improvements observed in the KT+PNF group may be attributed to the neuromuscular facilitation effect of PNF, together with the proprioceptive support provided by Kinesio Taping.

TABLE I
DIFFERENCES IN HAMSTRING FLEXIBILITY BETWEEN GROUPS

Outcome	Analysis	Effect	F (df)	p-value
AKE test	RM-ANOVA	time	F(1,9) = 45.5	< .001
		time × group	F(2,9) = 11.7	.003
		Group	F(2,9) = 19.1	< .001
	Post Hoc (Bonferroni)	Kt+PNF vs Control	—	.004
		Kt+PNF vs PNF	—	< .001
		Control vs PNF	—	.770
Sit-and-Reach test	RM-ANOVA	time	F(1,9) = 288.1	< .001
		time × group	F(2,9) = 72.9	< .001
		Group	F(2,9) = 5.51	.027
	Post Hoc (Bonferroni)	Kt+PNF vs Control	—	.036
		Kt+PNF vs PNF	—	.102
		Control vs PNF	—	1.000

IV. CONCLUSIONS

In conclusion, both PNF stretching and KT combined with PNF were effective in improving hamstring flexibility, with the combined intervention showing greater effectiveness. These findings suggest that integrating taping techniques with stretching protocols may benefit football players by improving flexibility and potentially reducing injury risk. Future research should consider larger sample sizes and longer intervention periods to further investigate long-term effects.

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