Agility Enhancement Through Progressive Fluctuated And Regressive Training In Hockey

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Abstract
The present study aimed to examine the impact of progressive, fluctuated, and regressive training protocols on the agility performance of male field hockey players. Sixty male athletes were randomly assigned to four groups: progressive training, fluctuated training, regressive training, and a control group. Over a duration of eight weeks, each experimental group underwent its respective training regimen. Agility was assessed through pre- and post-tests. Data were analyzed using analysis of variance (anova) followed by post-hoc comparisons to identify significant differences among the groups. Findings indicated that all experimental training methods led to measurable improvements in agility. Notably, the progressive training group exhibited the most consistent advancements in strength and endurance, while the fluctuated training group demonstrated superior agility improvements. The study concludes that structured variations in training intensity can produce specific enhancements in physical performance, which can be strategically applied to meet the demands of field hockey.

Keywords: progressive training, fluctuated training, regressive training, agility, physical performance, field hockey

Introduction

Field hockey is a high-intensity sport that demands exceptional levels of strength, speed, agility, and endurance. Enhancing these physical attributes requires the implementation of well-structured training protocols. Among the widely adopted models in sports conditioning are progressive training (characterized by linear loading), fluctuated training (variable intensity), and regressive training (tapering or deloading strategies). While these training paradigms are common across athletic disciplines, limited comparative research has been conducted within the context of field hockey. The current study addresses this gap by investigating the impact of these three distinct training methodologies on key physical performance variables, particularly agility, in male field hockey players.

Progressive training protocol (ptp)

The progressive training protocol was formulated to apply the principle of gradual overload by systematically increasing the training intensity over time. Participants in this group engaged in sessions that progressively enhanced the difficulty through incremental adjustments to the volume, intensity, and complexity of the exercises. The program included elements of resistance training, sprinting, and aerobic conditioning. For example, resistance load was increased by 5–10% weekly, and aerobic sessions were lengthened in terms of duration or intensity. The core objective was to stimulate continual physiological adaptation, targeting improvements in muscular strength, cardiovascular capacity, and agility. All training sessions were closely monitored to ensure correct technique, and progression was personalized based on individual baseline performance and recovery.

Fluctuated training protocol (ftp)

The fluctuated training protocol followed an undulating training model where intensity and volume varied frequently across training sessions or weeks. Rather than a fixed progression, this method introduced alternating patterns of high-, moderate-, and low-intensity sessions to avoid monotony, reduce the risk of overtraining, and stimulate varied neuromuscular responses. A typical example involved a high-intensity resistance workout (85–90% of 1rm), followed by a moderate (70–75%) and a low-intensity (50–60%) recovery session. The same variation strategy was applied to agility and endurance drills. This non-linear format is especially beneficial for field hockey players who must respond quickly to unpredictable game scenarios. Additionally, the variable structure helped maintain athlete engagement and allowed for recovery optimization.

Regressive training protocol (rtp)

The regressive training protocol was designed to evaluate the effects of reduced training loads over time, commonly used during tapering phases or recovery periods. Initially, the training mimicked the intensity of the progressive model, but over the weeks, load and volume were systematically decreased. Resistance training was scaled down by 5–10% weekly, while aerobic and speed drills were shortened in duration and intensity. This approach allowed for the conservation of previously gained fitness while facilitating physical recovery. Regressive training is typically applied during pre-competition phases to reduce fatigue and enhance performance readiness. This study explored how such a tapering method could still yield performance maintenance or modest improvement in agility and physiological efficiency.

Methodology

This study examined the comparative effects of three structured training protocols—progressive, fluctuated, and regressive—on agility among male collegiate field hockey players. A total of 60 male athletes aged between 17 and 25 were selected from colleges in the salem district, tamil nadu. The participants were randomly assigned into four groups: experimental group i – progressive training, experimental group ii – fluctuated training, experimental group iii – regressive training and control group – no specialized training

Preliminary orientation

To ensure clarity and voluntary participation, an initial meeting was organized where the study's aims, procedures, and expectations were clearly communicated to all participants. This step was essential in promoting commitment and cooperation throughout the intervention period.

Training intervention

Each experimental group underwent its respective training protocol over a period of eight weeks. The training was delivered thrice a week on alternate days, with each session lasting approximately 60 minutes. Each protocol was specifically designed to target the physical fitness component of agility, as aligned with the nature of field hockey performance.

Training procedure

The structured interventions were as follows group i followed the progressive training protocol group ii engaged in fluctuated training group iii undertook the regressive training protocol control group continued with their regular routines without additional training. All training interventions were carefully supervised, and athlete compliance was regularly monitored to ensure the fidelity of the protocol.

Statistical technique

Agility was measured pre- and post-intervention. The collected data were statistically analyzed using analysis of covariance (ancova) to adjust for any initial differences among groups. Where the ancova revealed significant differences in adjusted post-test means, scheffé's post hoc test was used to identify specific group differences. A significance level of $p < 0.05$ was maintained throughout the statistical analysis to test the research hypothesis.

Results and analysis

The effectiveness of each training protocol on agility was evaluated after the eight-week intervention. All participants were assessed both before and after the intervention period. The results demonstrated that all three experimental groups exhibited improvement in agility. Statistical analyses using dependent t-tests and ancova confirmed significant performance changes, especially in the fluctuated training group, which showed the most notable improvement in agility. Where significant 'f' ratios were observed, post hoc comparisons revealed meaningful differences among the training groups, supporting the hypothesis that varied training models yield distinct impacts on physical performance outcomes.

Table – 1: Analysis of covariance among progressive training group i, fluctuated training group ii, regressive training group iii and control group on agility

	Progressive training group	Fluctuated training group	Regressive training group	Control group	Source of variance	Sum of square	Degrees of freedom	Mean square	F-value
Pre test mean	0.167	0.166	0.167	0.166	Between		3		1.08
					Within		56		
Post test mean	0.152	0.156	0.146	0.166	Between	0.003	2	0.01	3.07*
					Within	0.019	56		
Adjusted post mean	0.152	0.158	0.145	0.168	Between	0.004	3	0.002	4.42*
					Within	0.017	55	0.001	

*significant at 0.05 level of confidence

Descriptive statistics were computed for the pre-test, post-test, and adjusted post-test scores of the selected dependent variable across four groups: progressive training, fluctuated training, regressive training and control. The pre-test mean values indicated minimal variation among groups—: progressive (0.167), fluctuated (0.166), regressive (0.167), and control (0.166)—highlighting that all participants began the study at comparable baseline levels. An analysis of variance (anova) performed on the pre-test data confirmed this uniformity, revealing no statistically significant differences among the groups **(**f = 1.08**,** p > 0.05**),** thus ensuring baseline equivalence.

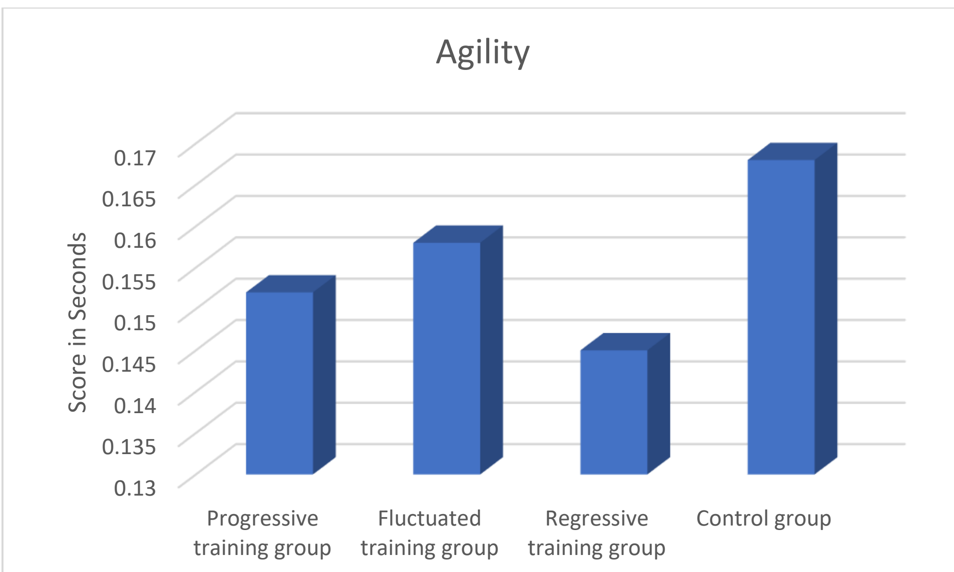
In contrast, the post-test results showed notable differences in group means: progressive (0.152), fluctuated (0.156), progressive (0.146), and control (0.166). The anova conducted on the post-test data indicated a statistically significant difference among the groups **(**f = 3.07**,** p < 0.05), suggesting varied effects of the different training interventions.

To further refine the analysis and control for initial disparities, analysis of covariance (ancova) was employed, treating the pre-test scores as covariates. The adjusted post-test mean scores were: progressive (0.152), fluctuated (0.158), regressive (0.145), and control (0.168). The ancova findings revealed a significant difference across the adjusted means **(**f = 4.42**,** p < 0.05**),** confirming that the training protocols led to meaningful differences in performance outcomes.

Among the experimental conditions, the regressive training group demonstrated the greatest improvement in the dependent variable, while the control group showed the least progress, indicating minimal or no effect without specific intervention. These findings underscore the effectiveness of targeted training methods in enhancing physical performance metrics.

Figure

Bar diagram adjusted post test mean values of progressive training group , fluctuated training group , regressive training group and control group on agility



Conclusion

The findings of this study clearly demonstrate that training protocols significantly influence agility performance among male field hockey players. Over the eight-week intervention period, all three experimental groups—progressive training, fluctuated training, and regressive training—showed varying levels of improvement in agility compared to the control group, which exhibited negligible change. Statistical analysis through ancova revealed that the differences in adjusted post-test means were significant ($f = 4.42$, $p < 0.05$). Among the experimental groups, the regressive training group recorded the most notable enhancement in agility, indicating that a strategically tapered training approach can yield substantial performance gains, likely due to better recovery and adaptation.

The fluctuated training group also demonstrated significant agility improvement, suggesting that non-linear variation in training intensity can stimulate neuromuscular responses and prevent adaptation plateaus. Although the progressive training group showed improvements as well, its effect on agility was slightly less pronounced compared to the other two protocols.

These results affirm that carefully designed and periodized training methods can be effectively employed to enhance specific physical performance variables in athletes.

Recommendations

Based on the findings of this study, the following recommendations are proposed:

1. Incorporate regressive training prior to competitions: coaches and trainers should consider implementing regressive (tapered) training programs in the weeks leading up to key tournaments to optimize agility performance and reduce fatigue.
2. Use fluctuated training for long-term development: fluctuated or undulating training models may be beneficial for sustaining motivation and physiological adaptability during long-term training cycles, especially in sports requiring multi-directional speed and agility.
3. Combine methods for periodized planning: a combined approach using progressive, fluctuated, and regressive phases in a periodized training plan may yield comprehensive benefits, addressing both foundational development and peak performance readiness.
4. Monitor athlete response individually: training loads should be customized based on individual recovery, performance feedback, and fitness assessments to prevent overtraining and ensure effective adaptation.
5. Further research: future studies may explore the long-term effects of these training protocols on other performance variables such as speed, strength, endurance, and injury prevention across different age groups and performance levels.

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