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Influence of progressive fluctuated and regressive training patterns on strength fitness and physiological responses in male hockey players

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Abstract
The purpose of this study was to examine the effect of progressive, fluctuated, and regressive training on upper and lower extremity strength, physical fitness, and physiological variables among male hockey players. A total of 45 male college hockey players were randomly selected from colleges affiliated with Periyar University, Salem, Tamil Nadu, India. The subjects, aged between 18 and 25 years, were divided into three equal groups of 15 each: Experimental Group I, Experimental Group II, and a Control Group. Experimental Group I underwent an 8-week progressive resistance training program, Experimental Group II followed an 8-week fluctuated (regressive) training program, and the Control Group did not participate in any specific training regimen. Pre- and post-tests were conducted for all groups. Data were analyzed using Analysis of Covariance (ANCOVA), and when the F-ratio was significant, Scheffé's post hoc test was applied to determine specific group differences. Results revealed that all three experimental training methods—progressive, fluctuated, and regressive—produced significant improvements in upper and lower extremity strength, physical fitness, and physiological variables compared to the control group. Furthermore, differences among the experimental groups indicated varying levels of effectiveness, with progressive training showing the highest improvement.

Keywords: Progressive training, fluctuated training, regressive training, hockey, strength, physical fitness, physiological variables

Introduction
Resistance training is a fundamental component in enhancing athletic performance, especially in sports that demand strength, power, and endurance such as hockey. According to Steve Maisch (2016), one of the primary goals of resistance training is to train the body under fatigue, thereby encouraging recruitment of a broader range of muscle fibers to optimize power output and efficiency.

Typically, resistance training involves alternating phases of isometric and dynamic contractions. The isometric component pre-fatigues the muscles, compelling the neuromuscular system to recruit additional fibers during subsequent dynamic exercises. This adaptation results in enhanced muscular activation and improved performance in explosive activities such as sprinting or jumping.

Previous studies have shown that resistance training interventions ranging from 4 to 8 weeks can significantly enhance vertical jump, sprint speed, and overall power output. However, variations in training patterns—such as progressive, fluctuated, or regressive loading—may yield different levels of physiological and performance benefits. Despite their practical importance, limited research exists comparing these three distinct training methods among hockey players.

Methodology
To achieve the purpose of this study, 45 male college-level hockey players (aged 18–25 years) were selected from colleges affiliated with Periyar University, Salem, Tamil Nadu, India. The subjects were randomly assigned to three equal groups of 15 participants each:

- **Experimental Group I:** Progressive training
- **Experimental Group II:** Fluctuated training

- **Experimental Group III:** Regressive training
- **Control Group:** No specific training

The experimental groups participated in their respective resistance training programs for 8 weeks, with three sessions per week (on alternate days), each session lasting 60 minutes in addition to their regular hockey practice.

The dependent variables selected were upper and lower extremity strength, physical fitness, and physiological variables. Pre-test and post-test data were collected for all participants.

Statistical Technique

The collected data were analyzed using Analysis of Covariance (ANCOVA) to determine significant differences among the groups. Whenever the adjusted post-test means yielded significant F-values, Scheffé's post hoc test was used to identify pairwise differences. The level of significance was set at 0.05.

Results and Analysis

Table 1: Analysis of Covariance on Speed

Groups	Pre-Test Mean	Post-Test Mean	Adjusted Post-Test Mean	F-Value
Progressive	7.13	7.03	7.03	34.91*
Fluctuated	7.13	7.08	7.08	
Regressive	7.12	6.96	6.97	
Control	7.13	7.13	7.13	

*Significant at 0.05 level of confidence

Table 2: Analysis of Covariance on Explosive Power

Groups	Pre-Test Mean	Post-Test Mean	Adjusted Post-Test Mean	F-Value
Progressive	2.02	2.13	2.14	44.05*
Fluctuated	2.04	2.09	2.08	
Regressive	2.01	2.19	2.20	
Control	2.04	2.05	2.03	

*Significant at 0.05 level of confidence

Table 3: Analysis of Covariance on Resting Heart Rate

Groups	Pre-Test Mean	Post-Test Mean	Adjusted Post-Test Mean	F-Value
Progressive	80.93	75.26	75.30	34.54*
Fluctuated	81.20	77.86	77.72	
Regressive	80.80	75.86	75.99	
Control	81.00	81.53	81.52	

*Significant at 0.05 level of confidence

Conclusion

The results of the study revealed that all three experimental training programs—progressive, fluctuated, and regressive—significantly improved upper and lower extremity strength, physical fitness, and physiological variables such as speed, explosive power, and resting heart rate when compared to the control group.

Among the three, progressive training demonstrated the most pronounced improvement, followed by fluctuated and regressive training. These findings suggest that systematic and progressive resistance training is an effective method for enhancing both the physical and physiological performance of male hockey players.

Recommendations

1. Similar studies may be conducted among female athletes while considering age, skill level, and other physiological factors.
2. Future research could integrate nutritional interventions or sport-specific drills along with resistance training to examine combined effects on performance.
3. Long-term studies may be conducted to assess the sustainability of performance gains achieved through these training methods**.**

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