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CHANGES ON POWER RELATED PARAMETERS DUE TO THE EFFECT OF DIFFERENT INTENSITY OF SPEED TRAINING

[1]Mr. Chintamalla Rajeev Gandhi & [2] Dr. S. Alagesan

[1]Ph.D. Scholar & [2]Associate Professor

Dept of Physical Education, Annamalai University. Chidambaram, Tamilnadu, India.

Abstract: The purpose of the present study was to investigate the changes on power related parameters due to the effect of different intensities of speed training. Power is an important component of physical fitness and is essential for successful performance in many sports and games. The study was designed to determine whether Low, Moderate, and High-Intensity speed training would produce different improvements in selected power components. 60 College men students were selected as participants and randomly assigned to three experimental groups, High Intensity Speed Training Group(HIST), Medium Intensity Speed Training Group (MIST), Low Intensity Speed Training Group(LIST) and a Control group. The experimental groups participated in their respective speed-training programs for a specified period, while the control group continued their regular physical activities. Selected speed components such as maximum Anaerobic power and Elastic Power were assessed using appropriate standardized tests. Pre-test and post-test measurements were obtained and analyzed using appropriate statistical techniques. It was hypothesized that different intensities of speed training would significantly improve selected power components and that the magnitude of improvement would differ among the training groups. The findings of the study may provide useful information for physical education teachers, coaches, and strength and conditioning professionals in designing effective speed-training programmes for college students.

Key words: Intensity Training, Speed, Anaerobic Power, Elastic Power

I. Introduction

1.Introduction

Speed training is a critical aspect of athletic conditioning that aims to enhance an athlete's ability to generate rapid movement and explosive power. The effectiveness of speed training in improving different components of power such as explosive force, elastic energy utilization, and anaerobic capacity depends significantly on the intensity at which the training is performed. Different training intensities elicit specific physiological adaptations that contribute to overall power development. High-intensity speed training, including maximum effort sprints, plyometric drills, and ballistic movements, primarily targets the neuromuscular system, enhancing the recruitment of fast-twitch muscle fibers, increasing rate of force development, and improving the elastic properties of muscles and tendons (**Cormie, McGuigan, & Newton, 2011)**. Such training emphasizes short, intense bouts of activity that stimulate adaptations in the stretch-shortening cycle, leading to improvements in explosive power critical for many sports. Moderate-intensity speed training, involving submaximal sprints or repeated efforts at slightly less than maximum effort, aids in developing muscular endurance and technical efficiency, which indirectly support power development by promoting better movement economy and coordination **(Baker, 2001).** This type of training can also improve metabolic capacity, allowing athletes to sustain high-power outputs over longer durations. Low-intensity speed exercises, such as light drills or drills performed at submaximal speeds, serve primarily as active recovery or technique refinement. While they may not directly enhance power, they are essential for maintaining training volume, preventing fatigue, and ensuring proper movement mechanics, which are fundamental to maximizing power output during high-intensity efforts.

Elastic power refers to the ability of the muscles and tendons to store and release elastic energy during dynamic movements, such as jumping and sprinting. This capacity is critical for explosive performance and is predominantly influenced by the stretch-shortening cycle (SSC). Improvements in elastic power are often associated with plyometric training, which enhances the musculotendinous unit's ability to efficiently utilize stored elastic energy **(Cormie, McGuigan, & Newton, 2011).** Anaerobic power represents the maximum capacity of the anaerobic energy systems (ATP-PC system and glycolysis) to produce energy rapidly during high-intensity, short-duration efforts. It is a key determinant of performance in activities such as sprinting, weightlifting, and jumping **(Baker, 2001)**. Testing methods such as the Wingate Anaerobic Test are commonly used to assess anaerobic power, providing measures like peak power and mean power outputs. Training interventions like sprint training, resistance training, and high-intensity interval training (HIIT) have been shown to enhance anaerobic power by increasing muscle mass, enzyme activity, and phosphagen system efficiency **(Bangsbo & Kiens, 2010).** Research indicates that plyometric exercises can significantly increase elastic power by improving muscle-tendon stiffness and neuromuscular coordination **(Markovic & Mikulic, 2010).** These adaptations lead to more effective energy transfer and greater explosive outputs during athletic movements.

2. Methodology

This study was designed to find out the effect of different intensities of speed training on selected power related components among college men students. For this study, sixty (N=60) male college students were selected as subjects. The age, of the subjects were ranged from 19 to 23 years. The study was designed to determine whether low-, moderate-, and high-intensity speed training would produce different improvements in selected power components.

3. Training procedure

They were randomly assigned into four groups of fifteen each (n=15). The Participants were randomly assigned to three experimental groups namely Low, Medium And High Intensity speed training for twelve weeks at the rate of three days a week and the group IV acted as control. The training program was designed with sessions held thrice weekly (e.g., Monday, Wednesday, Friday). Each session lasted approximately 60 minutes, including warm-up, main training activities, and cool-down. The program aimed to improve sprinting speed, reaction time, and agility through structured speed training exercises at different intensities. The program such as High-Intensity Speed Training (HIST), Exercises performed at 90-100% of maximum effort, Moderate-Intensity Speed Training (MIST) Exercises performed at 60-70% of maximum effort and Low Intensity Speed Training (LIST) performed at 45 – 55% effort and No specific speed training program offered for the Control Group they continued the regular activities. The training drills which includes for the three experimental groups were

Sprint Drills, such as Short sprints of 30-50 meters at maximum effort, 6-8 repetitions per session with 2-minute rest intervals for HIST Group for MIST Group they went Similar sprints at 60-70% effort, 8-10 repetitions, with 1-minute rest intervals and for (LIST) they went similar drills at 45 to 55% effort 4-5 repetitions with 3 minutes rest intervals. The Agility Exercises such as Cone drills, shuttle runs, and zigzag sprints emphasizing quick directional changes, performed at high effort for the HIST Group and for the MIST Group, Similar drills were performed at moderate effort focusing on technique and control.

4. Statistical Technique

All the subjects were tested prior to and immediately after the experimental periods on the selected dependent variables such as anaerobic power and elastic power was measured by Margaria-Kalamen Power Test and Countermovement Jump (CMJ) Test respectively. The data obtained from the experimental groups before and after the experimental period were statistically analyzed with Analysis of covariance (ANCOVA). Whenever the'F' ratio for adjusted post-test means was found to be significant, the Scheffe's test was applied as post-hoc test to determine the paired mean differences. The level of confidence was fixed at 0.05 levels for all the cases.

5. Analysis of the data and results

The results of analysis of covariance on data collected prior to and after the experimental period on the selected variables among the control group, and the intensities such as high, medium and low intensity group are presented in tables.

Table-1

Analysis of Covariance on Anaerobic Power Among Control Group Low Medium and High Intensity Group

	CONTROL GROUP	HIST GROUP	MIST GROUP	LIST GROUP	S O V	Sum Of squares	Df	Mean squares	F- ratio
Pre Test Mean	92.40 0.51	92.53 0.52	92.67 0.72	92.47 0.64	Between	0.583	3	0.194	0.533
					Within	20.400	56	0.364	
Post Test Mean	92.53 0.52	97.20 0.56	94.87 0.91	93.47 0.64	Between	185.383	3	61.794	135.22*
					Within	25.600	56	0.457	
Adjusted post Test Mean	92.64	97.19	94.73	93.51	Between	174.382	3	58.127	345.99*
					Within	9.244	55	0.168	

Table F-ratio at 0.05 level of confidence for 3 and 56 (df) =2.77

* Significant at 0.05 level.

The above table shows that the pretest means of control group, HIST group, MIST group and LIST training group were 92.40 (±0.51), 92.53 (±0.52), 92.67 (±0.72) and 92.47(±0.64) respectively. The obtained F value of 0.533 was less than the required table value 2.77. This proved that there was no significant mean difference between the groups at pretest period. The posttest means of the variable anaerobic power among control group, HIST group, MIST group and LIST group were 92.53 (±0.52), 97.20 (±0.56) 94.87(±0.91), 93.47 (±0.64), respectively. The obtained F value of 135.22 was greater than the required table value of 2.77. This proved that there was a significant mean difference among the groups after the twelve weeks training. The adjusted posttest means of the control group, HIST group, MIST group and LIST group were 92.53,97.20,94.87 and 93.47 respectively. The obtained F value of 135.22 was greater than the required table value of 2.77. This proved that there was a significant mean difference among the three groups.

Since the obtained F ratio of the adjusted post test means was found to be significant, Scheffe's post hoc test was applied. The obtained paired mean differences among the training and control group, between the training groups and the confidence interval required for significance are presented in table-IV.

Table -2

Scheffe's Confidence Interval Test Scores and the Mean Differences between the Groups on Anerobic Power

Means of				PAIRED MEAN DIFFERENCE	CONFIDENCE INTERVAL
CONTROL GROUP	HIST GROUP	MIST GROUP	LIST GROUP		
92.64	97.19			4.55*	0.43
92.64		94.73		2.09*	0.43
92.64			93.51	0.87*	0.43
	97.19	94.73		2.46*	0.43
	97.19		93.51	3.68*	0.43
		94.73	93.51	1.22*	0.43

The paired mean difference obtained for control group with HIST group, MIST group and LIST group were 4.55, 2.09 and 0.87 respectively. The paired mean difference between HIST Group and MIST group, HIST group and LIST group and MIST group and LIST group were 2.46, 3.68 and 1.22 respectively. All the paired mean differences were higher than the confidence interval value. The results of the study also show that all the three trainings had resulted in a significant improvement in speed as compared with control group. Among the three training groups, HIST group was better among the three intensities of speed training on anaerobic power

Table-3

Analysis of Covariance on Elastic Power Among Control Group Low Medium and High Intensity Group

	CONTROL GROUP	HIST GROUP	MIST GROUP	LIST GROUP	S O V	Sum Of squares	Df	Mean squares	F- ratio
Pre Test Mean	9.23 0.08	9.20 0.08	9.24 0.08	9.22 0.09	Between	0.014	3	0.005	0.71
					Within	0.373	56	0.007	
Post Test Mean	9.25 0.08	9.83 0.07	9.63 0.09	9.42 0.07	Between	2.846	3	0.949	158.17*
					Within	0.340	56	0.006	
Adjusted post Test Mean	9.24	9.84	9.62	9.42	Between	2.976	3	0.992	330.67*
					Within	0.152	55	0.003	

Table F-ratio at 0.05 level of confidence for 3 and 56 (df) =2.77

* Significant at 0.05 level.

The above table shows that the pretest means of control group, HIST group, MIST group and LIST training group were 9.23 (±.0.08), 9.20 (±0.52), 9.24(±0.08) and 9.22(±0.09) respectively. The obtained F value of 0.71 was less than the required table value 2.77. This proved that there was no significant mean difference between the groups at pretest period. The posttest means of the variable elastic power among control group, HIST group, MIST group and LIST group were 9.25 (±0.08), 9.83 (±0.07) 9.63(±0.09) 9.42 (±0.07), respectively. The obtained F value of 158.17 was greater than the required table value of 2.77. This proved that there was a significant mean difference among the groups after the twelve weeks training. The adjusted posttest means of the control group, HIST group, MIST group and LIST group were 9.24, 9.84, 9.62 and 9.42 respectively. The obtained F value of 330.67 was greater than the required table value of 2.77. This proved that there was a significant mean difference among the three groups.

Since the obtained F ratio of the adjusted posttest means was found to be significant, Scheffe's post hoc test was applied. The obtained paired mean differences among the training and control group, between the training groups and the confidence interval required for significance are presented in table-IV.

Table -4
Scheffe's Confidence Interval Test Scores and the Mean Differences between the Groups on Elastic Power

Means of				PAIRED MEAN DIFFERENCE	CONFIDENCE INTERVAL
CONTROL GROUP	HIST GROUP	MIST GROUP	LIST GROUP		
9.24	9.84			0.60*	0.06
9.24		9.62		0.22*	0.06
9.24			9.42	0.42*	0.06
	9.84	9.62		0.22*	0.06
	9.84		9.42	0.42*	0.06
		9.62	9.42	0.20*	0.06

The paired mean difference obtained for control group with HIST group, MIST group and LIST group were 4.55, 2.09 and 0.87 respectively. The paired mean difference between HIST Group and MIST group, HIST group and LIST group and MIST group and LIST group were 2.46, 3.68 and 1.22 respectively. All the paired mean differences were higher than the confidence interval value. The results of the study also show that all the three trainings had resulted in a significant improvement in speed as compared with control group. Among the three training groups, HIST group was better among the three intensities of speed training on Elastic power.

6. Discussion

Speed training is a critical component in enhancing athletic performance, particularly in sports requiring rapid movements and explosive power. The influence of training intensity on specific power parameters such as elastic power and anaerobic power has garnered considerable research interest. Elastic power refers to the ability of the musculotendinous units to store and rapidly release elastic energy during dynamic movements, which is crucial for activities involving explosive actions like sprinting and jumping **(Komi, 2000).** Studies have shown that plyometric and high-intensity speed training can significantly improve elastic power by enhancing the stretch-shortening cycle efficiency **(Markovic & Mikulic, 2010).** For instance, a study by **Spurrs et al. (2003)** noted that higher intensity plyometric training led to greater improvements in reactive strength index, a measure closely related to elastic power. Anaerobic power pertains to the capacity to generate energy without oxygen, primarily during short, intense efforts. Speed training at varying intensities can influence anaerobic capacity, with higher intensities promoting greater adaptations in anaerobic enzyme activity and phosphagen system efficiency **(Baker et al., 1993).** Research by **Ronnestad et al. (2010)** demonstrated that anaerobic power significantly increases following high-intensity speed training regimes, owing to enhanced glycolytic enzyme activity and muscle buffering capacity. The intensity of speed training appears to be a pivotal factor determining the extent of improvements in elastic and anaerobic power. Higher intensity training protocols tend to induce more substantial neuromuscular adaptations, leading to increased elastic recoil efficiency and anaerobic capacity (**Zafeiridis et al., 2005).** Conversely, moderate or low-intensity training might result in more modest gains, emphasizing the importance of training intensity specificity. the findings suggest that increasing the intensity of speed training can enhance both elastic and anaerobic power, albeit through different physiological mechanisms. High-intensity speed training promotes neuromuscular adaptations that improve elastic recoil properties and anaerobic energy systems, contributing to superior explosive performance.

7. Conclusions

Based on the results of the study it was concluded that

1. High Intensity (HIST), Moderate Intensity (MIST) and Low Intensity (LIST) significantly improved the selected power related variables such as Anaerobic Power and Elastic Power compared to control group among college level students.
2. Among the three High Intensity (HIST), Moderate Intensity (MIST) and Low Intensity (LIST) training groups, the High Intensity (HIST) was found better than the other training groups in improving power related variables such as Anaerobic Power and Elastic Power for the selected athletes.

8.References

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