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Impact of Plyometric SAQ and Traditional Training on Bio Motor Variables in School-Level Handball Players

[*1]Dr. B Loganathan

[*1]Physical Director, Government College of Engineering, Erode Anna University, Chennai, Tami Nadu, India.

Abstract

The purpose of this study was to examine the impact of plyometric, SAQ (Speed, Agility, and Quickness), and traditional training methods on selected bio-motor variables in school-level handball players. A total of 60 handball players, aged 14-17 years, were selected and randomly assigned into three groups: plyometric training group, SAQ training group, and a traditional training group, with 15 participants in each group. The training programs lasted for 12 weeks, with each group following a specialized training protocol designed to enhance specific bio-motor variables such as strength, speed, agility, and explosive power. Pre- and post-test measurements were taken on selected performance variables, including 30m sprint time, vertical jump height, and agility test scores. The results revealed that both plyometric and SAQ training significantly improved agility when compared to traditional training. Among the training groups, plyometric training showed the greatest improvement in agility, while SAQ training had a significant impact on agility. These findings suggest that plyometric and SAQ training are more effective than traditional training in enhancing bio-motor variables crucial for handball performance. Coaches and trainers are encouraged to integrate these training methods to optimize the athletic performance of school-level handball players.

Keywords: Plyometric training, SAQ training, traditional training, bio-motor variables, handball players, sprint performance, explosive power, agility.

Introduction

Sport plays a significant role in modern society, impacting individuals, communities, nations, and even the global stage. It reflects societal developments and is an institutionalized, competitive activity that demands physical exertion and complex motor skills. Participants engage in sports not only for intrinsic satisfaction but also for external rewards that come from their involvement.

The primary goal of sports training is to enhance athletic performance. This is achieved by focusing on multiple aspects of human personality, as sports performance is not determined by a single factor. To improve performance, a sportsman's total personality-including physical, mental, and emotional attributes-must be developed.

Engagement in sports contributes to a higher quality of life. It strengthens various body systems, increases lung capacity, and improves cardiovascular efficiency, allowing more oxygen to circulate in the blood. This, in turn, benefits overall health. For adolescents, sports play a crucial role in enhancing motor skills, growth, and development. The skills gained from sports can lead to long-term performance improvements and help with adaptation to various life challenges. An individual's environment often influences the local sports culture and the type of sport they choose to participate in.

SAQ Training

SAQ Training (Speed, Agility, and Quickness) refers to a specialized training approach aimed at improving an athlete's ability to move efficiently and rapidly in various directions. This type of training focuses on enhancing key aspects such as acceleration, deceleration, and rapid changes of direction, all of which are critical for sports that require explosive movements, quick reactions, and agility. SAQ drills typically involve exercises that challenge the body's coordination, footwork, reaction time, and ability to execute sharp, controlled movements.

The training often combines sprinting exercises, ladder drills, cone drills, and shuttle runs, targeting the development of both lower body power and upper body coordination. Through progressive intensity and variations, SAQ training improves an athlete's performance by refining movement mechanics and increasing neuromuscular adaptation. It's particularly beneficial in sports like basketball, football, handball, and soccer, where quick decision-making and rapid movement are vital for success.

Plyometric Training

Plyometric Training is a type of exercise that focuses on enhancing an athlete's explosive power and overall performance through rapid stretching and contracting of muscles. It involves dynamic movements that combine strength and speed to produce quick, forceful reactions. These exercises typically include jumps, bounds, and hops, designed to improve the muscles' ability to generate maximum force in the shortest amount of time.

The goal of plyometric training is to increase muscular power, specifically in the lower body, by leveraging the stretch-shortening cycle. This cycle involves a quick pre-stretch (eccentric phase) followed by an immediate contraction (concentric phase), which leads to increased force output.

***Corresponding Author:** Dr. B Loganathan

Common plyometric exercises include box jumps, depth jumps, squat jumps, and bounding drills.
By incorporating plyometric exercises into a training regimen, athletes can enhance their vertical jump, sprint speed, and overall agility. This training is particularly beneficial for sports that require rapid changes in direction, explosive starts, and powerful jumps, such as basketball, volleyball, and track and field.

Methodology

A total of 60 school-level handball players, aged 14-17 years, were selected for this study. All participants were actively involved in competitive handball and were randomly assigned into three different training groups were Plyometric Training Group (PTG) – 15 players, SAQ Training Group (SAQG) – 15 players, Traditional Training Group (TTG) – 15 players nd control group. Selection of Variables, The study focused on selected bio-motor variables that are critical for handball performance Agility (measured through an agility shuttle run test)

Training Protocols

The training duration was set for 12 weeks, with sessions conducted three times per week. The following training protocols were adopted for each group Plyometric Training Group (PTG) the plyometric training program focused on exercises that enhance explosive power and agility. Exercises included box jumps, squat jumps, bounding, depth jumps, and hurdle hops. The intensity and volume were progressively increased over the 12 weeks. SAQ Training Group (SAQG) The SAQ training program emphasized drills aimed at improving speed, agility, and quickness. Exercises included ladder drills, cone drills, shuttle sprints, and lateral quickness exercises. These drills were designed to enhance footwork, reaction time, and acceleration. Traditional Training Group (TTG) The traditional training program focused on general fitness and handball-specific skills. Exercises included aerobic conditioning, strength training, dribbling, passing, and shooting drills. The training intensity remained consistent throughout the 12-week period. Control Group (CG). A control group of 20 players did not undergo any structured training during the study period but continued their regular handball practices. Pre- and Post-Test Measures Sprint Speed was assessed by a 30-meter sprint test, where the time taken to cover the Agility was measured through a shuttle run, with time taken to complete the drill recorded.

Statistical Analysis

The data collected from the pre-test and post-test were analyzed using Analysis of Covariance (ANCOVA) to determine the differences between the groups. Post-hoc analysis using Scheffé's test was applied to identify specific pairwise differences among the groups. A significance level of 0.05 was set for all statistical tests.

Results and Analysis

The impact of the independent variables on the selected criterion variables was analyzed and is presented below. The training program lasted for twelve weeks, and the dependent variables included in this study was Bio motor variables (agility). All participants underwent testing on the selected dependent variables both before and immediately after the training period. The data collected from the experimental groups during the pre-test and post-test phases were statistically analyzed using the dependent *t*-test and Analysis of Covariance (ANCOVA). When the adjusted post-test means showed a significant *F*-ratio, Scheffé's post-hoc test was employed to identify the specific pairwise differences among the groups. A significance level of 0.05 was used for all statistical tests.

Table 1: Analysis of covariance among the plyometric, saq traditional training and control group on agility.

Test	Group	Mean	Source	Sum of Square	df	Mean Square	F-ratio
Pre-test	PTG	11.12	B/S	0.01	3	0.004	0.06
	STG	11.12					
	TTG	11.12	W/S	4.13	56	0.07	
	CG	11.15					
Post test	PTG	10.78	B/S	1.66	3	0.55	8.29
	STG	10.75					
	TTG	10.80	W/S	3.74	56	0.07	
	CG	11.16					
Adjusted Post test Mean	PTG	10.78	B/S	1.41	3	0.47	33.46
	STG	10.74					
	TTG	10.80	W/S	0.77	55	0.01	
	CG	11.16					

**Significant at 0.05 level (2.76)*

Results of Agility

Table 1 reveals the F-value for pre-test 0.06 and post-test 8.29 among the experimental groups plyometric training group, SAQ training group, traditional training group and control group on agility. To be significant at 0.05 level for degree of freedom 3,56 the required table value was 2.76. The F-ratio 0.06 obtained for pre-test was found to be insignificant since it does not reach the required critical value 2.76. Regarding the F-ratio for post-test mean 8.29 it was found statistically significant since it was higher than their required table value 2.76. Based on F-ratio it was inferred that experimental group and control group were equal in this performance of agility before they were included into their respective treatment whereas, after completion of 12 weeks treatment period, experimental groups and control group were significantly different from one another in the performance of agility.
The F-ratio for agility 33.46 obtained for adjusted posttest mean was found to be significant at 0.05 level for degree of freedom 3, 56 the required critical value was 2.76. Based on the results, in testing the hypothesis that there was significant difference among the effects of training namely plyometric, SAQ traditional training and control group on agility. The mean value of agility of plyometric training group, SAQ training group, traditional training group and control group were graphically represented in figure 1.

Table 2: The schefe's post hoc test on agility

Plyometric Training Group	SAQ Training Group	Traditional Training Group	Control Group	M.D	C.I
10.78	10.74			0.04	0.09
10.78		10.80		0.02	
10.78			11.16	0.38*	
	10.74	10.80		0.06	
	10.74		11.16	0.42*	
		10.80	11.16	0.36*	

**Significant at 0.05 level of confidence.*

The mean difference between plyometric training group and control group and between SAQ training group and control group and between traditional training group and control group on agility were 0.38, 0.42 and 0.36 respectively. The values of mean difference of adjusted posttest means were higher than the required confidence interval value of 0.09 and it was found to be significant.

Thus, the mean differences of paired adjusted posttest mean between plyometric training group and SAQ training group and between plyometric training and traditional training group and between SAQ training group and traditional training group were 0.04, 0.02 and 0.06 respectively were lesser than the required confidence interval value of 0.09 it was found to be insignificant at 0.05 level of confidence.

Since the obtained mean difference between plyometric training group and control group and between SAQ training group and control group and between traditional training group and control group were greater than the obtained confidence interval value on agility.

Further the obtained mean differences between plyometric training group and SAQ training group and between plyometric training and traditional training group and between SAQ training group and traditional training group were lesser than the obtained confidence interval value on agility. Hence it is concluded that there were significant differences in the effect on agility.

The adjusted posttest mean values of experimental group and control group differentiation ability were given in graphical representation in Figure – 1

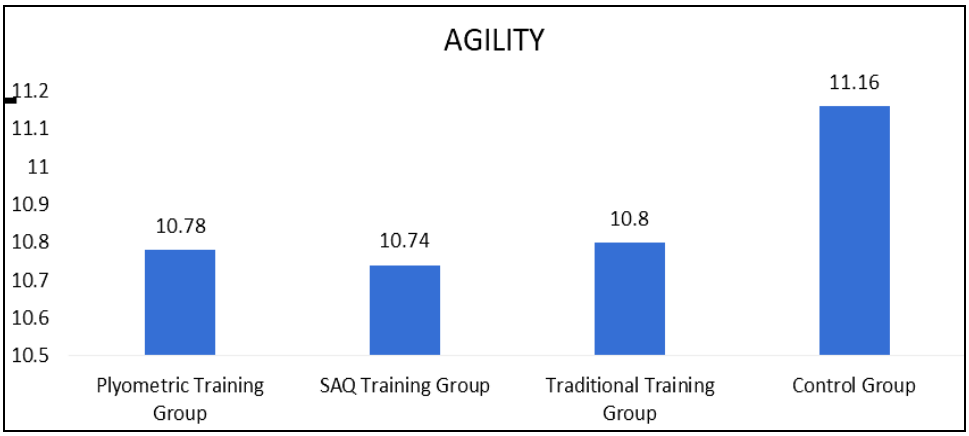

Fig 1: The mean values of adjusted posttest means on agility of plyometric training group SAQ training group traditional training group and control group.

Conclusion

The study investigated the impact of plyometric training, SAQ (Speed, Agility, and Quickness) training, and traditional training on selected bio-motor variables, such as agility, speed, and explosive power, among school-level handball players. The findings suggest that both plyometric and SAQ training methods led to significant improvements in agility, with plyometric training demonstrating superior results in enhancing this bio-motor variable. SAQ training also showed substantial improvements in agility, although not as significant as plyometric training. Traditional training, which focused on general fitness and handball-specific skills, showed moderate improvements in the selected bio-motor variables but was less effective compared to the specialized plyometric and SAQ training methods. The experimental groups (plyometric and SAQ) outperformed the control group, which did not receive any structured training.

These results indicate that integrating plyometric and SAQ training into the training regimen of handball players can significantly enhance their performance, particularly in areas critical for handball, such as agility and explosive power. Coaches and trainers working with school-level athletes are encouraged to incorporate these specialized training methods to optimize athletic performance and improve overall bio-motor capabilities.

Recommendations

Based on the findings of this study, the following recommendations are made for coaches and trainers working with school-level handball players:

i). **Incorporate Plyometric and SAQ Training:** The results of this study clearly show that plyometric and SAQ training are more effective than traditional training methods in improving agility and explosiveness, which are crucial for handball performance. Coaches should incorporate these training methods into their regular training regimens for enhanced player performance.

ii). **Progressive Training Program:** It is essential to structure plyometric and SAQ training programs in a progressive manner. Overloading the intensity gradually will help players improve their speed, agility, and explosive power without the risk of injury.

iii). **Emphasize Agility and Speed Development:** Given the importance of agility and quick movements in handball, incorporating regular drills that focus on agility, speed, and quickness will result in more effective training outcomes.

iv). **Monitor Player Progress:** Continuous monitoring of players' performance through pre- and post-test assessments, such as sprint times, vertical jump height, and agility tests, will help in adjusting training intensity and ensuring optimal development of the players' bio-motor variables.

v). **Long-Term Training Plans:** Although this study focused on a 12-week training program, long-term commitment to plyometric and SAQ training can yield even more significant improvements. Coaches should consider longer training periods for sustained performance gains.

vi). **Combine Various Training Methods:** While plyometric and SAQ training were more effective than traditional methods, integrating elements of traditional training with specialized programs could lead to balanced physical

development, covering all essential aspects of handball performance.

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