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Response of acceleration speed and multiple speed to maximal power training with Plyometrics training on team handball players

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Abstract
The study was designed to investigate the "Response of acceleration speed and multiple speed to maximal power training with plyometrics training on team handball players". To achieve this purpose forty college level men team handball players were randomly selected from Coimbatore district as subjects. Their age ranged between 18 and 25 years. The selected subjects were divided into two equal groups consisting of twenty each. No attempt was made to equate the groups. Experimental group I (n = 20) underwent maximal power training with plyometrics training (MPTWP), for a period of 12 weeks and group II (n = 20) acted as control group (CG), the subjects in control group were not engaged in any training programme other than their regular work. The criterion variables were chosen namely acceleration speed and multiple speed. The dependent variables were assessed before and after the 12 weeks of maximal power training with plyometrics. The collected data on acceleration speed and multiple speed were analyzed by computing mean and standard deviation. In order to find out the significant improvement if any, 't' test was applied. 0.05. The study revealed that the acceleration speed and multiple speed were significantly improved due to the influence of maximal power training with plyometrics training.

Keywords: Maximal Power Training, Plyometrics, Acceleration Speed, Multiple Speed, Team Handball

1. Introduction

Human muscle is composed of two broad categories of muscle cells (fibers). The slow twitch muscle fiber is characterized by high endurance, bur slow rate of force production and low power output. In contrast, the fast twitch fibers possess low endurance, but a fast rate of force production and high power output. Slow twitch fibers are innervated regularly by normal daily activity: however the fast twitch fibers are used only during muscle contractions requiring high force or rapid movement. In the aged there is a selective disuse atrophy of fast twitch fibers which is most likely a result of physical activity levels which have declined to a chronically low intensity (Evans and Campbell, 1993) [6]. The ability to generate maximal power during complex motor skills is of paramount importance to successful athletic performance across many sports. A crucial issue faced by scientists and coaches is the development of effective and efficient training programmes that improve maximal power production in dynamic, multi-joint movements. Such training is referred to as 'power training'.

According to Wilson (1994) [12], "Maximal explosive power training involves performance of dynamic weight training at the load which maximizes mechanical power output." This involves lifting loads in the range of 30 to 45 percent of maximum at high speed. It should be obvious that the exercises must not be typical weight-training exercises where the bar reaches zero velocity at the end of the movement. This would be counterproductive to the stated goal of raising explosive power.

One solution is to think of MPT as a marriage between strength training and plyometrics. "Maximal power training could be considered a form of plyometrics training that is specifically performed at a load which maximizes the power output of the exercise." The loading is greater than plyometrics because more resistance than body weight is used, but lighter than traditional weight training.

In selecting exercises for maximal power training, the key is to find those that allow for the production of the highest possible force throughout the entire range of motion. One of the best examples of this is the weighted squat jump. According to Baker (1995) [2], "The multiple repetition jump squats are associated with power outputs usually only generated by elite weightlifters during the second pull of the jerk thrust." In many sports and activities that require an explosive power from particular muscle contractions are rapidly followed by concentric contractions (Chu, 1992) [3]. Maximal Power performance has been shown to respond to training, which involves the athletes performing SSC movements with a stretch load greater and more rapid than to which they are accustomed. These activities have been termed "Plyometrics" and have been found in a number of studies, to be effective for increasing jumping ability (Adams, 1992) [1].

Handball is a popular game throughout the world, was introduced in Germany by a gymnastics teacher, Max Heiser, in 1917. The game was primarily devised for girls and played 11-a-side on a football field. There are, however, authentic reports of a similar game, "Hand bold" being played in Denmark as early as 1904 (Lohar, 1998). In many team sports such as football, handball, field hockey and rugby, speed is frequently associated with successful performance (Upton, 2011) [10]. The playing field for handball is 20 × 40 m

with an even effective smaller playing field, as the court players are not allowed inside the goalkeepers designated area. Given that the required distance to achieve maximal velocity for field athletes is 40 m from a standstill start and 29 m from a running start (Benton, 2000) and the playing field in handball is small, top speed is not likely to be achieved very often. Consequently, the ability to accelerate to considered being a more fundamental factor foe performance in team sports, rather than top speed (Cronin and Hanson, 2005). This is also true for other team sports (West, 2013) [11].

The hypothesis argued in this paper is that team handball players can significantly increase the acceleration speed and multiple speed by combining technical and tactical sessions with a maximal power training with plyometrics over a consecutive 12 weeks period. Therefore, the object of this study was to investigate the changes in the parameters produced during 12 weeks of maximal power training with in forty college level men team handball players.

2. Materials and Methods

2.1 Experimental Approach to the Problem

In order to address the hypothesis presented herein, we selected forty college level men team handball players. Their age ranged between 18 and 25 years. The selected subjects were divided into two equal groups consisting of twenty each. No attempt was made to equate the groups. Experimental group I (n = 20) underwent maximal power training with plyometrics training (MPTWP), for a period of 12 weeks and group II (n = 20) acted as control group (CG), the subjects in control group were not engaged in any training programme other than their regular work.

2.2 Design

The evaluated parameters were acceleration speed (20 m acceleration sprint) and multiple speed (6x40 m multiple sprint).The parameters were measured at baseline after 12 weeks of MPTWPT and the effects of the training were examined.

2.3 Training Protocol

In each training session the training was imparted for a period 60 minutes. The maximal power training with plyometrics, which included 5 minutes warming up and 5 minutes relaxation procedure after training programme for three days per week for a period of 12 weeks.

2.4 Statistical Analysis

The collected data were analyzed with application of 't' test to find out the individual effect from base line to post-test if any. 0.05 level of confidence was fixed to test the level of significance.

Table I: Summary of mean and 't' test for the pre and post tests on acceleration speed and multiple speed of control and experimental groups

Variables	Pre – test mean	Pre – test S. D (±)	Post – test mean	Post – test S. D (±)	't' ratio
MPTWPT Group					
Acceleration Speed	3.48	0.012	3.43	0.011	39.75*
Multiple Speed	39.07	0.122	39.02	0.086	22.99*
Control Group					
Acceleration Speed	3.50	0.17	3.49	0.22	1.45
Multiple Speed	39.15	0.428	39.14	0.431	1.19

* Significant at 0.05 level for the degrees of freedom 1 and 19

3. Results

In the present study the maximal power training with Plyometric training has improved the acceleration speed and multiple speed 1.44 % and 0.13 % over respectively by finding significant differences in comparison from baseline to post test.

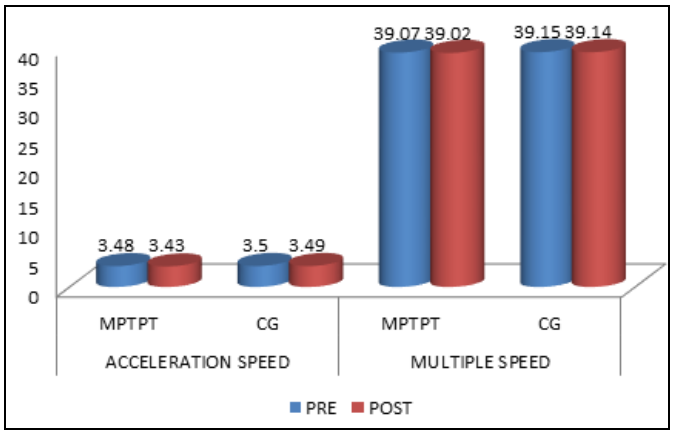

Fig 1

4. Discussion

The ability to run faster, to jump higher, to demonstrate greater agility and throwing velocity with great accuracy are the skills needed for successful play at all levels and all ages (Lidor, 2005) [9]. All these actions of physical activity, which play a fundamental role in handball, are anaerobic in nature (Hoffmann, 2000).

Delecluse (1997) [5] found maximal speed and acceleration to be specific qualities in sprint athletes. Sprints for short distances are fundamental in team handball during a fast break or while returning to defense after a ball loss. Earlier studies emphasized that first step quickness and acceleration are important to many sports (Cronin and Hansen, 2005).

Activities in team sports such as soccer, handball and basketball are comprised of varying explosive movement patterns (like forward, side-to-side and backward shuffles), runs at different intensities (e.g., from jogs to sprints), kicks, tackles, turns, jumps, and sustained forceful muscle contractions to control the ball against defensive pressure (Kalinski, 2002) [8].

It is our belief that the positive results found in the present study may be related, though in a subjective and empirical

way, to the athletes' adherence to the training program. Its unusual design and diversified structure may have contributed to improved performance and to the maintenance of high levels of motivation. Furthermore, we believe that such a program greatly contributes to motor learning with positive repercussions on future motor behaviours.

Twelve weeks of maximal power training with plyometrics training programme produced significant improvements in the acceleration speed, and multiple speed of men team handball players. Maximal power training with plyometrics training protocol to bring out desirable changes over motor fitness parameters for handball players. Thus a continuous and systemic maximal power training with plyometrics training aimed at maximizing performance capacity should be applied to college level men handball players.

The proposed maximal power training with plyometrics training programme should be a part of physical preparation of handball players, because of their significant influence on raising the level of the player physically and skillfully. It is necessary to raise the awareness of the trainers with the importance of the maximal power training with plyometrics exercises in the direction of the skill because of their significant influence on raising the physical and skillful level of handball players. Studies should be conducted in the same area on different samples in terms of age and gender.

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