

# Effect of Dynamic Neuromuscular Exercise Training on Explosive Arm Strength and Agility in Basketball Players

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## Abstract

**Background:** As Basketball requires high level conditioning abilities, it is necessary to have the arm and leg explosive power and agility to be derived at desired level. To achieve this derivation we have postulated the Dynamic Neuromuscular exercise training program for Basketball players. This could be useful to enhance their performance by improving their abilities. **Aim:** To study Effect of Dynamic Neuromuscular Exercise Training on Explosive arm strength and agility in Basketball Players. **Setting and Design:** Ethical approval was obtained from Institutional ethical committee. Subjects were selected by convenient sampling method. The players were evaluated for Agility and explosive arm strength. A survey among 68 players was done among which 60 patients participated based on inclusion criteria which were divided into two groups. **Methods and Material:** Experimental group (Group A, n=30) received Dynamic Neuromuscular Exercise Training Program for 4 days/week for 6 weeks whereas control group (Group B, n=30) received the conventional exercises. Pre and post treatment analysis was recorded using Illinois agility test and Medicine ball throw test. **Statistical Analysis:** Data was subjected to Shapiro-Wilk test which showed data does not pass normality test hence parametric pair and un-paired t test were performed to analyse the data within the groups. **Result:** Between group comparisons; group A (n=30, mean age= 21.37±2.12) showed extremely significant ( $p<0.0001$ ), improvement in Medicine ball throw test in pre (5.80±0.88) to post intervention (8.15±0.80) than group B (n=25, mean age=22.9±2.41) in pre (5.9±1.01) to post intervention (6.35±0.97). As well the Illinois agility test showed significant improvement ( $p<0.0001$ ) in group A (pre= 21.9±2.9 to post=17.85±1.6) than group B (pre=23.35±2.07 to post=22.67±2.10). **Conclusion:** Study concluded that there is significant effect of Dynamic Neuromuscular training on explosive arm strength and agility in basketball players.

**Keywords:** Basketball, Dynamic Neuromuscular Training, Illinois agility test, Medicine ball throw test.

## Introduction

In India, Basketball game began its journey in 1930 when it was played for the first time. Nowadays, basketball is considered as one of the widely played sports in India. Basketball in India is played in most of the high schools, colleges and universities as well as

there are specific Academies and Clubs accessible in India. There is substantial patronage for the game among the younger generation. In India Basketball is played by both men and women of all ages.<sup>1</sup>In particular, matches consist of 2 rounds (15-minute each with half time break in-between) during which an athlete has to produce a quick displacement of his/her body segment, dribbling, passing, shooting and rebound defence.<sup>2</sup>

There are many number of sports having their own distinctive skill set and performance characteristics that are necessary for an athlete to excel. In most sports, the ability to generate and transfer explosive power is

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a key element to success. The evaluation of the various expressions of strength and explosive power as well as the factors that contribute to their development is fundamental to enhancing performance of specific movement tasks as they relate to skills in a basketball sports.<sup>1</sup>

Basketball is one of the fastest team sports game which requires mastery over fundamental skills like dribbling, passing, shooting and rebound defence etc.<sup>3</sup> The multidirectional nature of the sport requires frequent changes in forward and backward movement and multiplane movements for defensive activities while other sports concentrate on single plane like running. The Basketball players advance the ball by bouncing it while walking or running (dribbling) or by passing it to a teammate, both of which require considerable skills.<sup>3</sup> In basketball, the ability to generate maximal strength levels in the shortest period of time (muscular power) is necessary to gain high sport performance levels. Moreover, agility is a vital component for the success in basketball players<sup>4</sup>

In basketball the Agility performance and Arm Explosive Strength performance is very important for an athlete to excel. Agility is considered crucial for team sports. In Basketball, notably, agility is a prerequisite for achieving high-performance success. Obviously, agility is required to quickly perform all-out technical-tactical movements in multidirectional planes by maintaining dynamic balance, speed, and precision. It characterizes the capability of an athlete to maintain and control correct body positions while quickly changing direction through a series of movements.<sup>5,6</sup> Arm Explosive Strength performance is important in physical conditioning of basketball players in and around the court and to reduce the risk of joint and tendon injuries during the game.<sup>6</sup>

Dynamic Neuromuscular training will demonstrate to reduce force absorption, active joint stabilization, muscle imbalance and function biomechanics while increasing strength of structural tissue (bones, ligament and tendon)<sup>1</sup>. Marked evidence shows that neuromuscular training programs are effective for improving measures of performance.<sup>1</sup> This training program design to produce fast form of powerful movement and improve function of nervous system, generally for the purpose of improving performance in sports.<sup>1</sup> It is also used to increase speed

or force of muscular contraction providing explosiveness for a variety of sports specific activity.<sup>1</sup>

These ancillary effects of neuromuscular training, which are likely related to the reduction of the risk of injury in athletes, are positive results of their training. Without the performance-enhancement training effects, however athletes may not be motivated to participate in a neuromuscular training program.<sup>1</sup>

Neuromuscular training aims to improve neuromuscular control thus increasing functional joint stability which may have a protective effect against injury. There has been a push toward identifying mechanism of preventing many of these injuries with one focus being the incorporation of neuromuscular training program.<sup>3</sup> In each sport requires different level of sensorimotor processes to perform skills and protect the neuromuscular system from injury. Many of their skills require great strength and sometimes exaggerated joint range of motion.<sup>7</sup>

This program can be design as it is a prevention oriented training which could improve sports performance and could be instituted on a large number of motivated athletes. Hence there is a need to study the effect of dynamic neuromuscular exercise training explosive arm strength and agility in basketball players.

## Method

Study setting was sports clubs in and around Pune. Total number of 60 basketball players were selected between age group 18-35 years of both genders with more than 6 months of experience were selected randomly. Permission was taken from the institutional ethical committee of Tilak Maharashtra Vidyapeeth, department of physiotherapy and different centres were approached. Subjects were approached for data collection from basketball sport clubs in & around Pune city, India. The aims and methods of the study was explained and their written consent was taken. Out of which 60 participants were selected randomly following the exclusion and inclusion criteria and were divided in two groups that is Group A and Group B. The players were evaluated for Agility and Arm explosive power by using Illinois agility test<sup>8</sup> and Medicine ball throw test<sup>9</sup>. A 6 weeks (4 days in a week) dynamic neuromuscular training was given to Group A that is to experimental

group and they were also following their regular training. Group B that is controlled group were given conventional exercises and they were asked to continue their regular training.

Protocol:

Exercise Program of Dynamic Neuromuscular training

Warm up: 10 mins of jogging, side shuffles and stretches

EXERCISES	REPETITIONS
Catching and throwing a weighted ball with partner	10 repetitions
Dribbling a ball on the floor or against a wall	10 repetitions
Swinging a weighted object in circular pattern	10 repetitions
Swinging a weighted object in pendular pattern	10 repetitions
Push off from wall	10 repetitions
Low oblique sit exercise	10 repetitions
Overhead slams with medicine ball	10 repetitions
Swing with medicine ball	10 repetitions
Mason twist with medicine ball	5 twists to each side
Repetitive jumping on floor in place	10 jumps
Forward, backward, side to side, diagonally to four corners jump with rotations zigzag jumping	10 jumps each
Running	5 mins
Box jumps	10 jumps
Ladder Drills	5 repetitions

Cool down: 5 min stretching and relaxation technique (Mitchell and Jacobson)

**Statistical Analysis:** The analysed data showed that it was not a normal distribution using shapro -Wilk test hence parametric test pair and un-paired t test were performed to analyze the data within the groups.

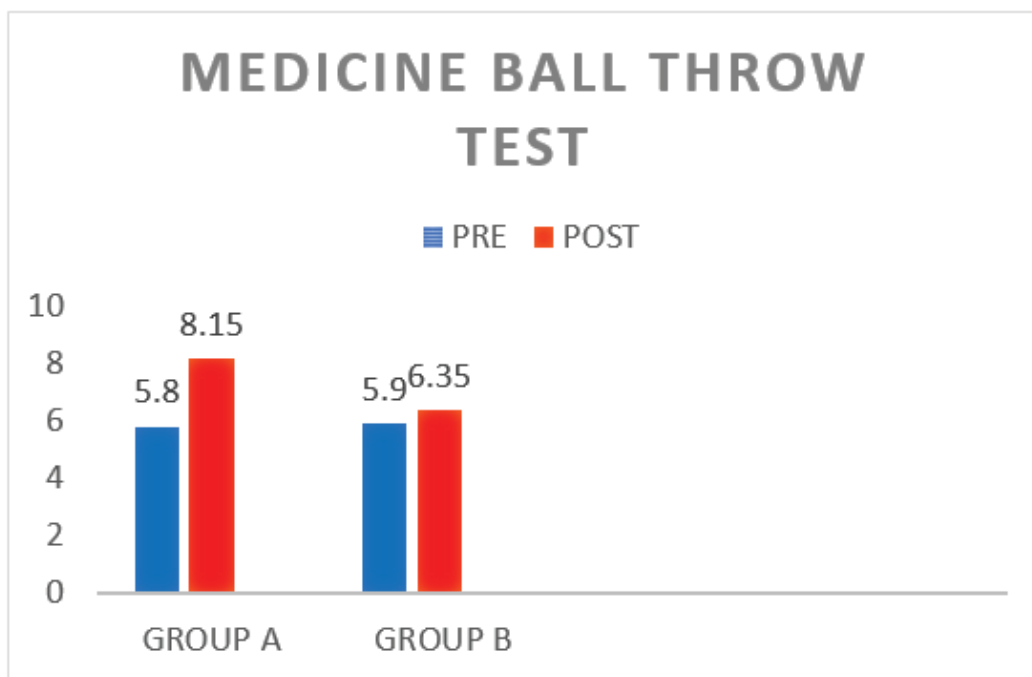
### Result

**Table 1: Distribution of players according to Demographic and clinical parameters.**

Parameters		Experimental group (n=30)	Control group (n=30)
Age		21.37 ± 2.12	22.9 ± 2.41
Gender	Male	17	18
	Female	13	12
MBTT	Pre	5.80 ± 0.88	5.9 ± 1.01
	Post	8.15 ± 0.80	6.35 ± 0.97
	P value	<0.0001	<0.0001
IAT	Pre	21.9 ± 2.9	23.35 ± 2.07
	Post	17.85 ± 1.6	22.67 ± 2.10
	P value	<0.0001	<0.0001

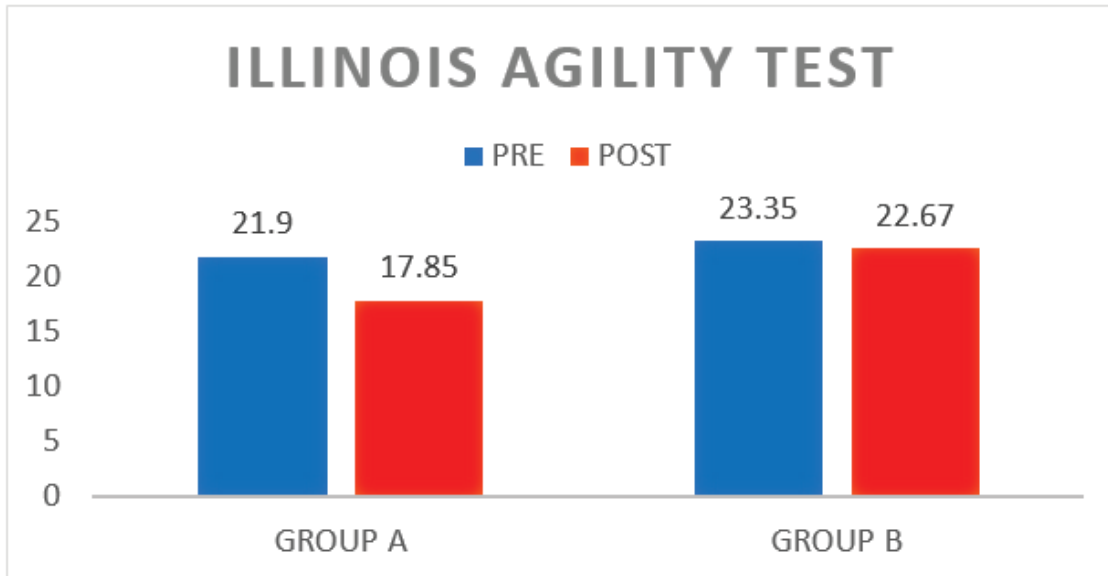
\* MBTT– Medicine ball throw test

\*IAT – Illinois Agility test



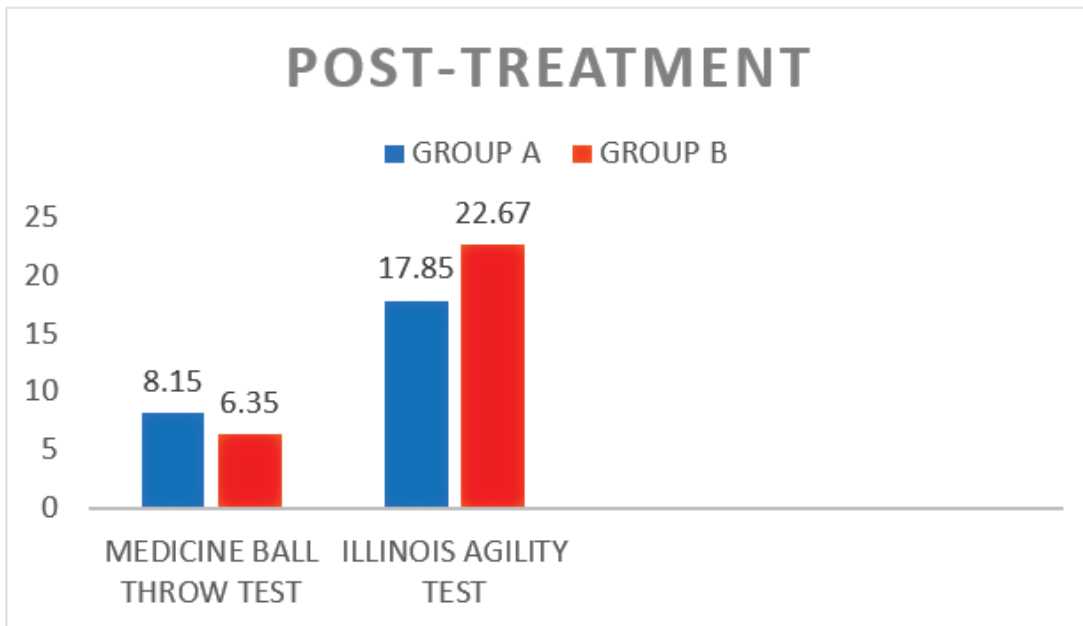
**Graph 1: Distribution of players according to Medicine ball throw test**

**Interpretation:** There was a significant increase in medicine ball throw test score which is suggestive of improvement in explosive arm strength after dynamic neuromuscular exercises.



**Graph 2: Represents the comparative values of Group A and Group B of Illinois Agility Test**

**Interpretation:** There was a significant reduction in Illinois agility test score which is shows improvement in speed after dynamic neuromuscular exercises.



**Graph 3: Comparison between Group A & Group B (Post Intervention) of Medicine ball throw test and Illinois agility test**

**Interpretation:**It has been observed that the average throwing distance of Group A has significantly increased to  $(8.15 \pm 0.80)$  as compared to Group B  $(6.35 \pm 0.97)$  after dynamic neuromuscular exercises with  $(p < 0.0001)$  which suggests improvement in explosive arm strength and the average running time of Group A has significantly decreased to  $(17.85 \pm 1.6)$  as compared to Group B  $(22.67 \pm 2.10)$  after dynamic neuromuscular exercises with  $(p < 0.0001)$  which suggests improvement in speed.

## Discussion

This project is based on the effect of dynamic neuromuscular training program in basketball players by using Medicine ball throw test and Illinois agility test. Medicine ball throw test (In figure 1) in which it was seen that group a (experimental) average throwing distance which is Pre ( $5.80 \pm 0.88$ ) and Post ( $8.15 \pm 0.80$ ) was at a significant increase ( $p < 0.0001$ ) in score then the group b (control) average throwing distance which is Pre ( $5.9 \pm 1.01$ ) and post ( $6.35 \pm 0.97$ ), this shows improvement in Explosive Arm Strength after dynamic neuromuscular exercises.

In figure 2 the basketball players also underwent Illinois Agility test in which it was seen that group a (experimental) average running time which is Pre ( $21.9 \pm 2.9$ ) and Post ( $17.85 \pm 1.6$ ) was reduced ( $p < 0.0001$ ), then group b (control) average running time which is Pre ( $23.35 \pm 2.07$ ) and Post ( $22.67 \pm 2.10$ ) this suggests that in our study, subjects who underwent dynamic neuromuscular exercise training were able to improve their time and distance significantly on both the Illinois agility test and Medicine ball throw test. Therefore, we found a positive relationship between dynamic neuromuscular exercise training and improvements of both agility test and explosive arm test.

This improvement in agility and power is beneficial for athletes who require quick movements while performing their sport and support results from other studies.<sup>10</sup>

In a study, Gregory D. Myer et al conducted a study to see the effect of Dynamic exercises and stabilization in Female athletes in 2006 in Ohio which concluded that the exercises were effective at increasing measures of neuromuscular power and control in female athletes by using Physical Performance Testing and Biomechanical Testing.<sup>1</sup>

When the muscle work is involved the isotonic contraction is required which helps in concentric muscle work and eccentric muscle work. The concentric muscle work is used to build up the muscle power, and although most everyday movements involve the use of all types of muscle work, it seems to be more natural and to require least concentric type. And in eccentric muscle work considerable concentration is required during exercises

designed to work the muscles in the way, this is probably to control the speed of the movement, as eccentric work in natural movements is usually fairly rapid.<sup>11</sup>

To our knowledge only few studies have aimed to determine the functional classification level and sport specific skill tests<sup>12</sup>, the power and endurance of the working muscles are maintained or increased in response to the tension created in them. The tension is greater when the exercises is performed at any speed which is slower, or more rapid, than when the natural speed of movement is employed, and it increases with duration of exercise. A high degree of tension and consequent increases in power can be developed by free exercises when the muscles work for any time against the resistance offered by the body weight, or against the mechanical disadvantage of an adverse leverage provided by a long and heavy limb.<sup>11</sup>

## Conclusions

Study concludes that there was significant effect of Dynamic Neuromuscular training on explosive arm strength and agility in basketball players.

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**Conflict of Interest:** None

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