A STUDY ON THE EFFECTIVENESS OF A SIX WEEK PLYOMETRIC TRAINING PROGRAM ON AGILITY

Registration Number

27091208

A DISSERTATION SUBMITTED TO

THE TAMIL NADU DR. M. G. R. MEDICAL UNIVERSITY, CHENNAI,

IN PARTIAL FULFILMENT OF THE REQUIREMENTS OF THE

DEGREE OF MASTER OF PHYSIOTHERAPY

APRIL 2011

A STUDY ON THE EFFECTIVENESS OF A SIX WEEK PLYOMETRIC TRAINING PROGRAM ON AGILITY

Head of the Institution: _____

Principal: _____

Dr.R.SHANKER M.P.T. (OG)
TMMF, MADURAI

A DISSERTATION SUBMITTED TO

THE TAMIL NADU DR. M. G. R. MEDICAL UNIVERSITY, CHENNAI,

IN PARTIAL FULFILMENT OF THE REQUIREMENTS OF THE

DEGREE OF MASTER OF PHYSIOTHERAPY

APRIL 2011

CERTIFICATE

This is to certify that the project entitled**A STUDY ON THE EFFECTIVENESS OF A SIX WEEK PLYOMETRIC TRAINING PROGRAM ON AGILITY** and was work done by **Mr. R. PRATHAP**, a bonafide student of Master of Physiotherapy (M.P.T.) Final Year student under The Tamil Nadu Dr. M.G.R Medical University, Chennai.

Registration Number: 27091208

Principal

A STUDY ON THE EFFECTIVENESS OF A SIX WEEK PLYOMETRIC TRAINING PROGRAM ON AGILITY

COLLEGE OF PHYSIOTHERAPY
TRINITY MISSION AND MEDICAL FOUNDATION
ULTRA TRUST
MADURAI
TAMIL NADU

Examiners:_____

_____

A DISSERTATION SUBMITTED TO
THE TAMIL NADU DR. M. G. R. MEDICAL UNIVERSITY, CHENNAI,
IN PARTIAL FULFILMENT OF THE REQUIREMENTS OF THE
DEGREE OF MASTER OF PHYSIOTHERAPY

APRIL 2011

ACKNOWLEDGEMENT

I express my thanks to **Prof K. ARUMUGAM,** Chairman, Ultra trust, for his permission to do this dissertation

I express my incalculable gratitude to **Prof. R.SHANKER MPT**, PRINCIPAL, Trinity mission and medical foundation, Ultra trust, for his valuable guidance in every stage of this dissertation.

My sincere gratefulness to my guide **MR. A.JOSEPH OLIVER MPT (Sports)** who guide me throughout the project work. I thank him very much for his timely advice, valuable suggestion, inspiring ideas to format this project and encourage me with new thoughts.

Its my pleasure to thank **Mr.B.RAM KUMAR MPT, Mr. J.SUDARSHAN MPT, Mrs.D.G.ANIMA MPT, Mr.ANANDH RAJ BPT, Mr. MOHAMMED AMEER HUSSAIN MPT, Mr.PITCHU MANI BPT & DMH Physiotherapy Team**, **Mr. THIRUNAVUKARASU Librarian** who gave their valuable suggestion in material collections.

I am greatly thankful to my friends **Mr. MANOJ, MR.VALLABAN, Mr. JAI GANESH** for their timely help to complete this fulfilled dissertation. I also acknowledge to help and co-operation rendered to my Athletes who participated in this study.

I wish thanks to YMCA college to physical education, Nandanam, Staffs and Students.

Last but not the least my sincere thanks to all my friends and family members for their support and encouragement throughout this study.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

Sports training refers to specialized strategies and methods of exercise used in various sports to develop athletes and prepare them for performing in sporting events. The goal of any athletic training program is to improve the specific physical capacities needed for that sport.

The term plyometric, as derived from its Greek roots, means to increase or augment. Such training has been used systematically in Track & Field by European coaches and athletes for nearly 25 years, although most American coaches consider it a recent phenomenon. In fact, most of us have been doing some form of plyometric exercise in all our lives. Jumping rope, playing hopscotch, leaping from the front porch, skipping, and bouncing are all plyometric movements. Understanding the mechanisms, technique, and proper application of plyometric training, however, is essential for it to be properly integrated into your own system of training.

Plyometrics are exercises that aim to develop explosive ability by conditioning the neuromuscular and elastic characteristics of the muscle. Strictly speaking, plyometric training is a method of training as opposed to a specific set of exercises. Muscles that start in a static position cannot generate as much force as those using the stretch-shortening cycle since the eccentric to concentric muscle action uses the elastic energy stored in the muscle.

A greater power output can be found when the stretch-shortening cycle is used because of the efficiency gained by releasing elastic energy stored in the muscles. The muscles react to the sudden stretch by sending a signal to the

central nervous system to resist the sudden stretch. In other words, the muscle is going to rebound rapidly from the sudden stretch. Considering this information plyometric training has the potential to develop quicker reaction times that leads to an increase in an athlete's speed and power. This type of training can improve performance in explosive sports that rely on moving speed and power such as hockey, basketball, track and field, football, and volleyball. Even though plyometric training has been used for many years, to our knowledge there has been very little research done using a sport specific plyometric program.

This confusion has led to the current study involving college -age male sportspersons and whetherplyometrics will improve power and speed. It is essential that sportspersons have power, explosiveness, quickness and agility to compete at their peak abilities some of which can be improved by plyometric training.

1.1 STATEMENT OF THE STUDY

The statement of the study was **Effectiveness of six week plyometric training program on agility.**

1.2 AIM OF THE STUDY

The aim of this study was to analyze the effectiveness of six week plyometric training program on agility.

1.3 OBJECTIVES OF THE STUDY

The objective of this study is to analyze the effectiveness of plyometric training regimen on agility in young male athletes.

1.4 NEED OF THE STUDY

Skill related fitness comprises of components such as agility, balance, coordination, power, speed, and reaction time. Sports persons require more strength, power, flexibility, agility, speed reflexes etc. An increase in any one of the above could bring about marked improvement in performance of the athlete. Plyometrics is believed to improve strength and agility. An attempt is made in this project to improve on the agility of sportspersons through a six week plyometrics training program

1.5 HYPOTHESIS

1.5.1 NULL HYPOTHESIS

There is no significant improvement in agility and performance of athletes following a six week plyometric training program.

1.5.2 ALTERNATE HYPOTHESIS

There is significant improvement in agility and performance of athletes following a six week plyometric training program.

1.6 OPERATIONAL DEFINITIONS

1.6.1 PLYOMETRICS

Plyometrics described any type of explosive movement for a series of repetitions at high speeds and high levels of intensity.

1.6.2 AGILITY

Agility is defined as the ability to perform a series of explosive power movements in rapid succession in opposing directions.

REVIEW OF LITERATURE

- **Corey M. Reyment, Megan E. Bonis, Jacob C. Lundquist, Brent S**(2006). Tice of the University of Wisconsin at Eau Claire, WI conducted a study titled "Effects Of A Four Week Plyometric Training Program On Measurements Of Power In Male Collegiate Hockey Players". In this study they have mentioned that the plyometric training two days a week for four weeks is not sufficient enough to show improvements in 40 yd dash times, 10 yd dash times, two foot vertical jump height, post minimum power and post relative minimum power (W/Kg).

- **Michael G. Miller , Jeremy J. Herniman , Mark D. Ricard , Christopher C. Cheatham and Timothy J. Michael**(2006) in their study titled "The Effects Of A 6-Week Plyometric Training Program On Agility" have mentioned that not only can athletes use plyometrics to break the monotony of training, but they an also improve their strength and explosiveness while working to become more agile. In addition, their results support that improvements in agility can occur in as little as 6 weeks of plyometric training which can be useful during the last preparatory phase before in-season competition for athletes.

- **S M Lephart (2005), J P Abt, C M Ferris, T C Sell, T Nagai, J B Myers, J JIrrgang** have conducted a study on "Neuromuscular and biomechanical characteristic changes in high school athletes: a plyometric versus basic resistance program". They have concluded that

the basic training alone induced a favorable neuromuscular and biomechanical changes in high school female athletes. The plyometric program may further be utilized to improve muscular activation patterns.

- **Lockwood and Brophey** (2004) tested six male hockey players from a Jr. B hockey team following a 4-week plyometric program and observed a significant drop in on - ice 40 m time from pre test to post test. The average drop was approximately .15s.A decrease in 10 m and 40 m sprint times was also seen at the conclusion of an 8 week study conducted with sprint specific plyometrics. In a 6-week study conducted by Polhemius et al (1980), subjects participated in a three day per week plyometric program while completing their conventional training programs. It was found that pre- to post-program 40 m dash times were significantly reduced.

- **Craig (2004), Miller et al. (2001), Parsons et al., Yap et al., and Young et al all** are of the same view that Plyometric drills usually involve stopping, starting and changing directions in an explosive manner. These movements are components that can assist in developing agility. These studies support our study as well.

- **Parsons and Jones, 1998; Renfro, 1999; Robinson and Owens, 2004; Roper, 1998; Yap and Brown**, **2000** have been suggested that increases in power and efficiency due to plyometrics may increase agility training objectives. They have used plyometric activities in sports such as football, tennis and soccer.

- **Luebbers et al (2003)** found that some aspects of performance actually decreased following a 4-week plyometric training program. Even though some studies have shown improvements using plyometrics in their programs there have been others that have shown little or no improvements. This was the case in the study conducted by Luebbers et al. In the study decreases in vertical jump performance (67.8 ± 7.9 cm) were observed following the 4-week plyometric program. Vertical jump values decreased to a mean of 65.4 ± 7.8 cm from 67.8 ± 7.9 cm after the plyometric training program. In other areas there were no significant changes found including anaerobic power.

- **Asmussen and Bonde-Peterson (1974), Cavagna (1977), Komi (1992), Miller et al. (2001), Pfeiffer (1999), Wathen (1993)** are all authors who agree that the stored elastic energy within the muscle (as a result of plyometrics) is used to produce more force than can be provided by a concentric action alone.

- **Baechle and Earle (2000)** say plyometrics consists of a rapid stretching of a muscle (eccentric action) immediately followed by a concentric or shortening action of the same muscle and connective tissue.

- **Gregory John Renfro (1999)**, have conducted a study "Summer Plyometric Training for Football and its Effect on Speed and Agility".

- **Chu (1998**) has mentioned in his study that the plyometrics are training techniques used by athletes in all types of sports to increase strength and explosiveness.

- **Stone and O'Bryant(1984)** believed that the plyometric activities have been used in sports such as football, tennis, soccer or other sporting events that agility may be useful for their athletes.

DESIGN AND METHODOLOGY

3.1 RESEARCH DESIGN

The research design of this study was done by **Experimental study**.

3.2 SELECTION CRITERIA

3.2.1 INCLUSION CRITERIA

- Subjects with age group of 20-30 years
- Male athletes
- Cooperative patients
- Subjects with no contraindications.

3.2.2 EXCLUSION CRITERIA

- Subjects with age group of below 20 or above 30 years.
- Female athletes
- Non Cooperative Patients.
- Subjects with muscle contractures or deformity.

3.3 POPULATION

Male athletes within the age group of 20-30 years were considered as the population of the study.

3.4 SAMPLE AND SAMPLING TECHNIQUE

Thirty subjects satisfying the inclusion criteria were selected from the population by 'Convenient Sampling Technique'.

3.5 VARIABLES OF THE STUDY

3.5.1 DEPENDANT VARIABLE

- Agility

3.5.2 INDEPENDENT VARIABLE

- Plyometric Training

3.6 SETTING OF THE STUDY

The study was conducted at YMCA College of Physical Education, Nandanam, Chennai.

3.7 MATERIALS USED FOR THE STUDY

- Cone
- Stop watch
- Tape
- Whistle

METHODOLOGY

Thirty subjects satisfying the inclusion criteria were selected from the population by 'Convenient Sampling Technique' and were divided in to two groups of fifteen subjects each.

- Experimental Group
- Control Group

The experimental group received the given six weeks of plyometrics training. The control group did not receive any training. They were assessed for pre and post test directly.

4.1 MEASUREMENT TOOLS

T TEST

Purpose: The T-Test is a test of agility for athletes and includes forward, lateral, and backward running.

Equipment required: Tape measure, marking cones, stopwatch, timing gates (optional)

Procedure: The subject starts at cone A. On the command of the timer, the subject sprints to cone B and touches the base of the cone with their right hand. They then turn left and shuffle sideways to cone C, and also touches its base, this time with their left hand. Then shuffling sideways to the right to cone D and touching the base with the right hand. They then shuffle back to cone B

touching with the left hand, and run backwards to cone A. The stopwatch is stopped as they pass cone A.

Scoring: The trial will not be counted if the subject cross one foot in front of the other while shuffling, fails to touch the base of the conesor fails to face forward throughout the test. Take the best time of three successful trials to the nearest 0.1 seconds.

Fig.4.1 Subject Sprints from cone A to cone B

Fig.4.2 Subject side shuffling from cone B to cone C

Fig.4.3 Subject side shuffling from Cone C to Cone D

Fig.4.4 Subject shuffling backwards from Cone B to Cone A

Fig.4.5 Subject back to the starting point

SHUTTLE RUN TEST

Purpose: This is a test of speed and agility which is important in many sports.

Equipment required: Wooden blocks, marker cones, measurement tape, stopwatch and non-slip surface.

Procedure: This test requires the person to run back and forth between two parallel lines as fast as possible. Set up two lines of cones 30 feet apart or use line markings and place two blocks of wood or a similar object behind one of the lines. Starting at the line opposite the blocks on the signal "Ready? Go!" the participant runs to the other line, picks up a block and returns to place it behind the starting line, then returns to pick up the second block, then runs with it back across the line.

Scoring: Two or more trails may be performed and the quickest time is recorded. Results are recorded to the nearest tenth of a second.

Fig.4.6 Subject starting towards the end line

Fig.4.7 Subject midway towards the end line

Fig.4.8 Subject picking up the wooden block

Fig.4.9 Subject completing the shuttle test

Fig.4.10 Subject repeating the run again

LATERAL CHANGE OF DIRECTION TEST

Purpose: This is a test of agility, including speed, quickness, flexibility, change of direction and body control**.**

Equipment required: Stopwatch, measuring tape or marked football field, marker conesand a flat non-slip surface.

Procedure:

1. Equipment needed were a flat surface (running track would be ideal), three cones, stop watch and an assistant.

2. Three cones were set five meters apart on a straight line.

3. The athlete started at the middle cone.

4. The coach gave the signal to start and pointed to a specific direction, right or left.

5. The athlete then moves and touches the first cone, returns past the middle cone (start) to the far cone, touches it and then returns to the middle cone, touching it too.

The coach starts the stopwatch on giving the 'GO' command and stops the watch when the athlete touches the middle cone. The best score out of the two circuits in each direction were recorded.

Scoring: The time to complete the test in seconds is recorded. The score is the best time of two trials.

Fig.4. 11 Subject in starting position

Fig.4.12 Subject starting from cone A

Fig.4.13 Subject reaching cone B

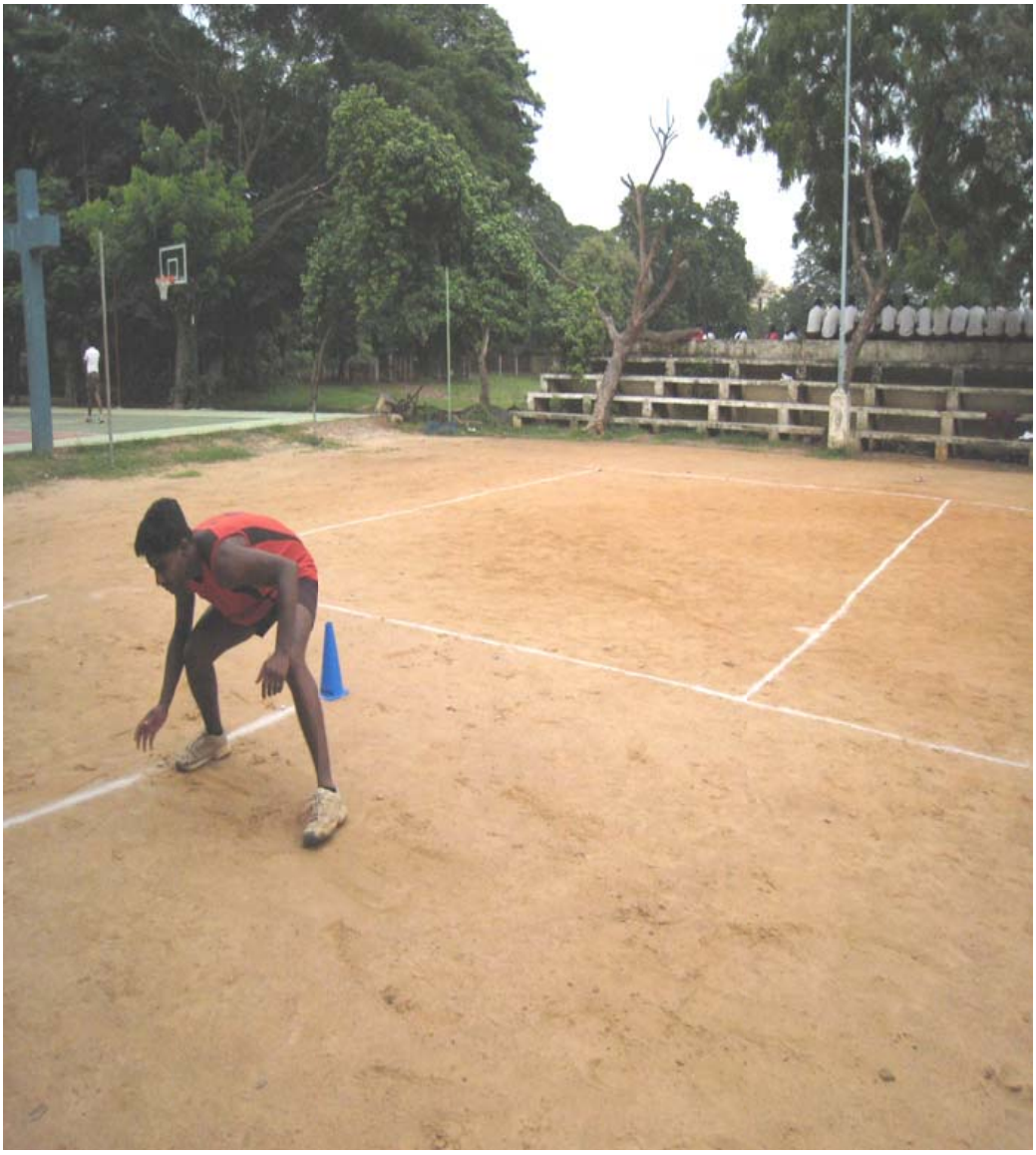


Fig.4.14 Subject reaching cone C

Fig.4.15 Subject back to starting position

4.2 Plyometric 6-week Training Protocol

Week 1		
Training Volume: 90 Foot contacts		
Plyometric Drill	**Sets X Reps**	**Training Intensity**
Side to Side ankle hops	2 X 15	Low
Standing jump and reach	2 X 15	Low
Front cone hops	5 X 6	Low

Week 2		
Training Volume: 120 Foot contacts		
Plyometric Drill	**Sets X Reps**	**Training Intensity**
Side to Side ankle hops	2 X 15	Low
Standing long jump	5 X 6	Low
Lateral jump over barrier	2 X 15	Medium
Double leg hops	5 X 6	Medium

Week 3		
Training Volume: 120 Foot contacts		
Plyometric Drill	**Sets X Reps**	**Training Intensity**
Side to Side ankle hops	2 X 12	Low
Standing long jump	4 X 6	Low
Lateral jump over barrier	2 X 12	Medium
Double leg hops	3 X 8	Medium
Lateral cone hops	2 X 12	Medium

Week 4		
Training Volume: 140 Foot contacts		
Plyometric Drill	**Sets X Reps**	**Training Intensity**
Diagonal cone hops	4 X 8	Low
Standing Long jump with lateral sprint	4 X 8	Medium
Lateral cone hops	2 X 12	Medium
Single leg bounding	4 X 7	High
Lateral Jump single leg	4 X 6	High

Week 5		
Training Volume: 140 Foot contacts		
Plyometric Drill	**Sets X Reps**	**Training Intensity**
Diagonal cone hops	2 X 7	Low
Standing Long jump with lateral sprint	4 X 7	Medium
Lateral cone hops	4 X 7	Medium
Cone hops with 180 degree turn	4 X 7	Medium
Single leg bounding	4 X 7	High
Lateral Jump single leg	2 X 7	High

Week 6		
Training Volume: 120 Foot contacts		
Plyometric Drill	**Sets X Reps**	**Training Intensity**
Diagonal cone hops	2 X 12	Low
Hexagon drill	2 X 12	Low
Cone hops with change of direction sprint	4 X 6	Medium
Double leg hops	3 X 8	Medium
Lateral Jump single leg	4 X 6	High

Fig.4.16 Ankle Hops

Fig.4.17 Front Cone Hops

Fig.4.18 Lateral Cone Hops

Fig.4.19 Single Leg Bounding

Fig.4.20 Lateral Jump Single Leg

Fig.4.21 Diagonal Cone Hops

4.3 OUTCOME MEASURES

The outcome measures of six week plyometric training program were taken for the subjects using T test, Shuttle run test, Lateral Change of direction test to measure agility. The data collected were analyzed by statistical procedure to find the significance.

4.4 OBSERVATION AND ANALYSIS

A separate proformawas used to record the pre and post intervention score for each subject.

The data collected were analyzed using the underlying statistical method.

ANCOVA

$$F = \frac{\text{Mean Sum of squares between}}{\text{Mean sum of squares within}}$$

$$\mathbf{y_{ij} = \mu + \alpha_1 + \beta\,(x_{ij} - x) + \varepsilon_{ij}}$$

where

y_{ij} = jth replicate observation of response variable

μ = mean value of response variable

α_1 = $\mu_1 - \mu$

β = combined regression coefficient

x_{ij} = covariate value for the jth replicate observation from the ith level of factor A

x = mean value of covariate

ε_{ij} = unexplained error assoc. with jth replicate observation from the ithlevel of factor A

Adjusted Y values:

$$\mathbf{y_{ij(adj)} = y_{ij} - \beta\,(x_{ij} - x) = \mu + \alpha_1 + \varepsilon_{ij}}$$

Adjusted Y means:

$$\mathbf{\mu_{i(adj)} = \mu_i - \beta\,(x_i - x)}$$

$$\mathbf{F = \frac{(SS_{with(adj)} - SSres)/(J-1)}{SSres/(N-2J)}}$$

whereSSres is the sum of squared residuals

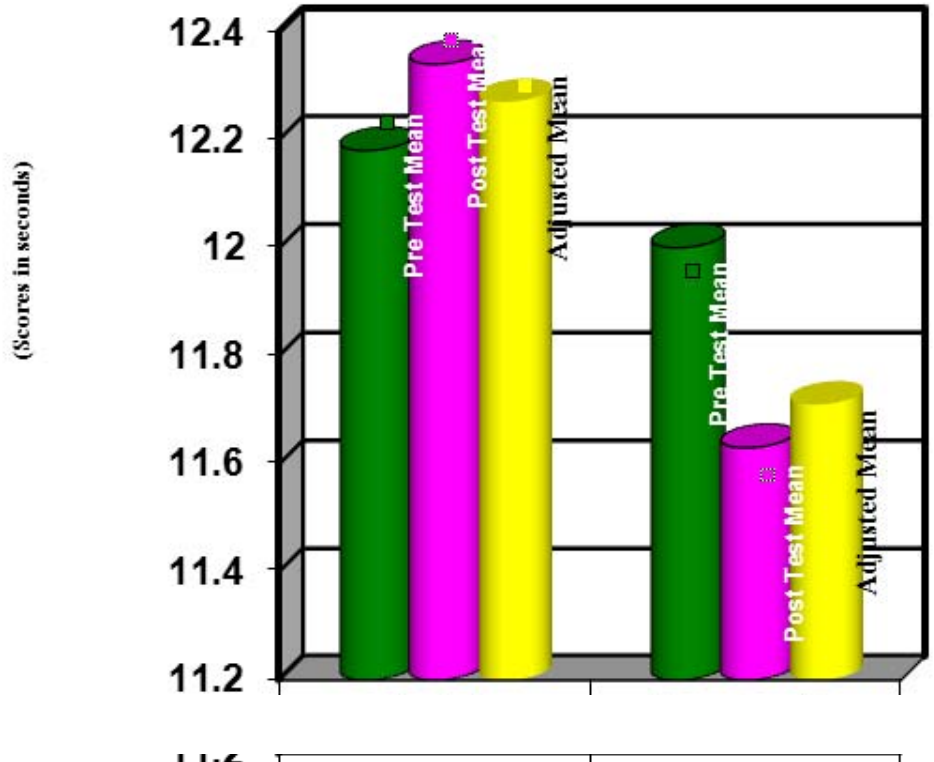
$$\mathbf{SSres = \sum_{j=1}^{J} SSj(1 - r^2 j)}$$

T-DRILL TEST

Table 1: Comparision of the pre-test and post-test mean values and adjusted mean for experimental and control groups

Test	CON.GROUP Sec	INT.GROUP Sec	sv	ss	df	MS	F	TV 0.05	TV 0.01
Pre test	12.18	12.00	between	0.2558	1	0.2558	1.57	4.21	7.68
			within	4.5577	28	0.1628			
Post test	12.34	11.63	between	3.7595	1	3.7595	27.48	4.21	7.68
			within	3.8305	28	0.1368			
Adjusted	12.27	11.71	between	2.1927	1	2.1927	81.19	4.21	7.68
			within	0.7291	27	0.027			
Mean gain	0.16	-0.37							

Figure 1
Bar diagram on Pre, Post and Ordered adjusted means of Agility - T-Drill Test



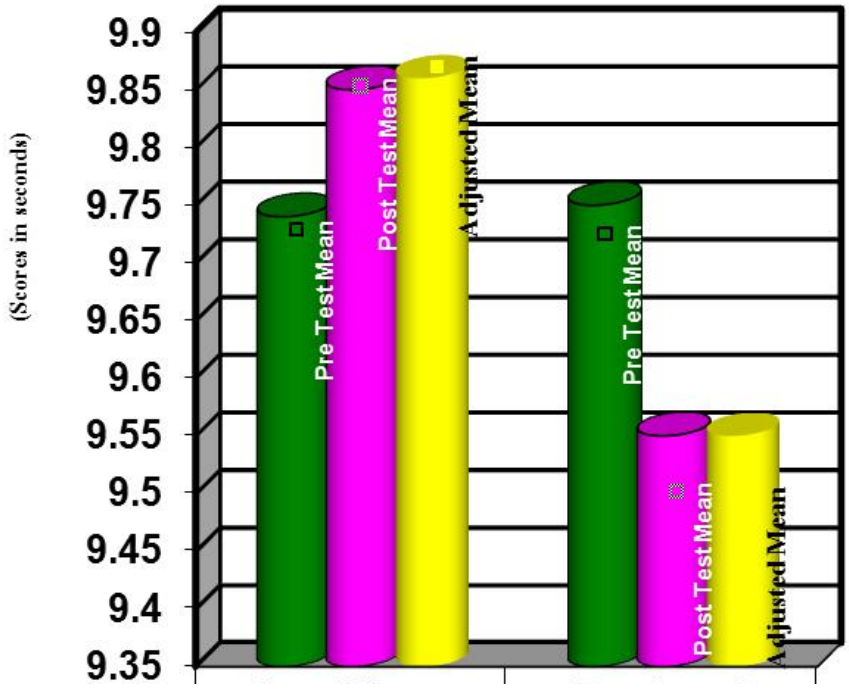
	Control Group	Experimental Group
Pre Test Mean	12.18	12
Post Test Mean	12.34	11.63
Adjusted Mean	12.27	11.71

SHUTTLE RUN TEST

Table 2: Comparision of the pre-test and post-test mean values and adjusted mean for experimental and control groups

Test	CON.GROUP Sec	INT.GROUP Sec	sv	ss	df	MS	F	TV 0.05	TV 0.01
Pre test	9.74	9.75	between	0.00	1.00	0.00	0.04	4.21	7.68
			within	0.58	28.00	0.02			
Post test	9.85	9.55	between	0.68	1.00	0.68	36.47	4.21	7.68
			within	0.52	28.00	0.02			
Adjusted	9.86	9.55	between	0.71	1.00	0.71	76.06	4.21	7.68
			within	0.25	27.00	0.01			
Mean gain	0.12	-0.20							

Figure 2
Bar diagram on Pre, Post and Ordered adjusted means of Agility - Shuttle Run Test



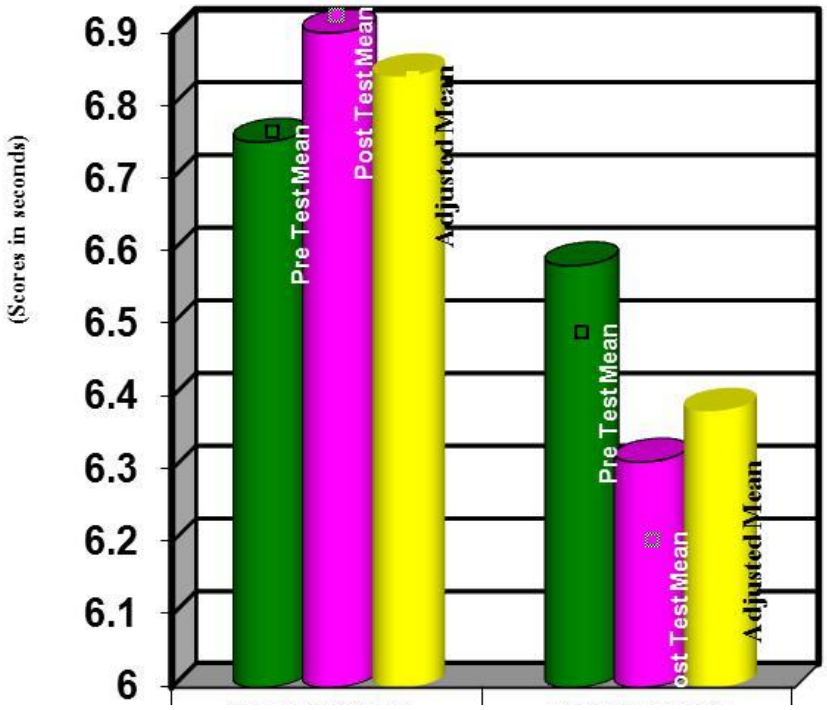
	Control Group	Experimental Group
Pre Test Mean	9.74	9.75
Post Test Mean	9.85	9.55
Adjusted Mean	9.86	9.55

LATERAL CHANGE OF DIRECTION TEST

Table 3: Comparision of the pre-test and post-test mean values and adjusted mean for experimental and control groups

Test	CON.GROUP Sec	INT.GROUP	sv	ss	df	MS	F	TV 0.05	TV 0.01
Pre test	6.75	6.58	between	0.2271	1	0.2271	5.72	4.21	7.68
			within	1.1103	28	0.0397			
Post test	6.9	6.31	between	2.7543	1	2.7543	64.62	4.21	7.68
			within	1.1933	28	0.0426			
Adjusted	6.84	6.38	between	1.3556	1	1.3556	76.15	4.21	7.68
			within	0.4806	27	0.0178			
Mean gain	0.15	-0.27							

Figure 3
Bar diagram on Pre, Post and Ordered adjusted means of Agility - Lateral Change of Direction Test



	Control Group	Experimental Group
Pre Test Mean	6.75	6.58
Post Test Mean	6.9	6.31
Adjusted Mean	6.84	6.38

RESULTS AND DISCUSSION

5.1 RESULTS

T DrillTest

The pretest, post test and adjusted mean values of the control group on agility were 12.18, 12.34 and 12.27 Secsrespectively. The pretest, post test and adjusted mean values of the experimental group on agility were 12.0, 11.63 and 11.71 Secsrespectively. The post test and pretest mean difference of control group on agility was 0.16 and the post test and pretest mean difference of experimental group on agility was -0.37 which revealed that the agility time was reduced comparing to the pretest. The obtained F value of pretest means of the groups 1.57 showed that there was no initial difference between the groups on agility. The obtained F value of post test means of the both groups 27.48 showed that there was a significant difference between the groups since the obtained F value was higher than the table value 4.21 and 7.68 at 0.05 and 0.01 levels respectively. Finally, the obtained F value on the ordered adjusted mean values of the both the groups 81.19 were higher than the table value 4.21 and 7.68 at 0.05 and 0.01 level respectively. Hence it was found that the polymeric training improved the agility performance significantly than the control group.

Shuttle Run Test

The pretest, post test and adjusted mean values of the control group on agility were 9.74, 9.85 and 9.86Secs respectively. The pretest, post test and adjusted mean values of the experimental group on agility were 9.75, 9.55Secs and 9.55 respectively. The post test and pretest mean difference of control group on agility was 0.11 and the post test and pretest mean difference of experimental group on agility was -0.20 which revealed that the agility time was reduced comparing to the pretest. The obtained F value of pretest means of the groups 0.04 showed that there was no initial difference between the groups on agility. The obtained F value of post test means of the both groups 36.47 showed that there was a significant difference between the groups since the obtained F value was higher than the table value 4.21 and 7.68 at 0.05 and 0.01 levels respectively. Finally, the obtained F value on the ordered adjusted mean values of the both the groups 76.06 were higher than the table value 4.21 and 7.68 at 0.05 and 0.01 level respectively. Hence it was found that the polymeric training improved the agility performance significantly than the control group.

Lateral Change of Direction Test

The pretest, post test and adjusted mean values of the control group on agility were 6.75, 6.9 and 6.84Secs respectively. The pretest, post test and adjusted mean values of the experimental group on agility were 6.58, 6.31 and 6.38Secs respectively. The post test and pretest mean difference of control group on agility was 0.15 and the post test and pretest mean difference of experimental group on agility was -0.27 which revealed that the agility time was reduced comparing to the pretest. The obtained F value of pretest means of the groups 5.72 showed that there was an initial difference between the groups on agility. The obtained F value of post test means of the both groups 64.62 showed that there was a significant difference between the groups since the obtained F value was higher than the table value 4.21 and 7.68 at 0.05 and 0.01 level respectively. Finally, the obtained F value on the ordered adjusted mean values of the both the groups 76.15 were higher than the table value 4.21 and 7.68 at 0.05 and 0.01 level respectively. Hence it was found that the polymeric training improved the agility performance significantly than the control group.

5.2 DISCUSSION

This study was started with the aim of analysing the effectiveness of a six week plyometric training regimen on speed and performance. The subjects with age group of 20-30 years, co-operative and with no contraincation were selected. In gender, only ,ales were selected for the study. A six week training program was administered. At the end of the six week program results were analysed.

The Experimental Group training was significantly effective at 99% level of significance. Experimental Group gained significant improvement in performance.

When the Control Group and Experimental Group data were analysed and compared, there was significant (99%) improvement in performance (agility) in the Experimental Group than with the Control Group. This was the benefit of the six week plyometric training program.

Hence, this study favours the hypothesis and rejects the null hypothesis. We can conclude that the six week plyometrics training is definitely more effective than other training methods of the same duration in improving agility.

5.3 LIMITATIONS OF THE STUDY

- The age groups of the samples were between 20-30 years. So the result of this study cannot be generalized over all the age groups.
- The size of the sample is too small to generalize the findings.
- A potential threat to the validity of the findings is that participants could not be blinded.

5.4 SCOPE FOR FURTHER STUDY

- This study was conducted among a small population. It can be done with more subjects.
- This study was done only in the male athletes. It can be done with female athletes also.
- This study was done in the younger age group 20-30 years of age. It can be done in the middle and older age group as well.
- This study has used only six week plyometric training program. A four week program or an eight week program can also be used in further studies.

CONCLUSION

The goal of any athletic training programme is to improve the specific physical capacities needed for that sport, plyometric is a term derived from its Greek roots, means to increases or augment. The present study is conducted to improve the agility of sports spersonsthrough a six week plyometrics training programme. Male athletes within the age group of 20-30 years were taken up for the study using the usual inclusion criteria.

The experimental group received the given six weeks of plyometric training and statistical analysis was done, By analyzing the data, improvement in the experimental group was noted.

Hence, it is concluded that the significant improvement in agility performance was obtained in the experimental group in corporated with six week plyometric training programme for male athletes. So, null hypothesis can be rejected and alternative hypothesis may be accepted.

REFERENCES

1. Adams, K., O'Shea, J.P., O'Shea, K.L. and Climstein, M.(1992) The effects of six weeks of squat, plyometrics, and squat plyometric training on power production. *Journal of Applied Sports Science Research* 6, 36-41.

2. Anderst, W.J., Eksten, F. and Koceja, D.M. (1994) Effects of plyometric and explosive resistance training on lower body power. *Medicine and Science in Sport and Exercise* 26, S31.

3. Asmussen, E. and Bonde-Peterson, F. (1974) Apparent efficiency and storage of elastic energy in human muscles during exercise. *ActaPhysiologicaScandinavica*92, 537-545.

4. Avery D.Faigenbaum, James E. McFarland, Fred B. Keiper, William Tevlin, Nocholas A. Ratamess, Jie Kang and Jay R. Hoffman (2000) Effects of a short-term plyometric and resistance training program on fitness performance in boys age 12 to 15 years. *Journal of Sports Science and Medicine(2007) 6,519-525*

5. Baechle, T.R. and Earle, R.W. (2000) *Essentials of strength training and conditioning.* 2nd edition. Champaign, IL: National Strength and Conditioning Association.

6. Barnes, M. and Attaway, J. (1996) Agility and conditioning of the San Francisco 49ers. *Strength and Conditioning* 18, 10-16.

7. Bebi, J., Cresswell, A., Engel, T. and Nicoi, S. (1987) Increase in jumping height associated with maximal effort vertical depth jumps. *Research Quarterly for Exercise and Sport* 58, 11-15.

8. Bobbert, M. (1990) Drop jumping as a training method for jumping ability. *Sports Medicine* 9, 7-22.

9. Brown, M.E., Mayhew, J.L. and Boleach, L.W. (1986) Effects of plyometric training on vertical jump performance in high school basketball players. *Journal of Sports Medicine and Physical Fitness* 26, 1-4.

10. Buttifant, D., Graham, K. and Cross, K. (1999) Agility and speed of soccer players are two different performance parameter. *Journal of Sports Science* 17, 809.

11. Cavagna, G. (1977) Storage and utilization of elastic energy in skeletal muscle. *Exercise and Sports Sciences Reviews* 5, 89-129.

12. Chu, D.A. (1998) *Jumping into plyometrics.* Champaign, IL: Human Kinetics.

13. Clutch, D., Wilton, B., McGown, M. and Byrce, G.R. (1983) The effect of depth jumps and weight training on leg strength and vertical jump. *Research Quarterly for Exercise and Sport* 54, 5-10.

14. Corey M. Reyment, Megan E. Bonis, Jacob C. Lundquist, Brent S. Tice. Effects of a Four Week Plyometric Training Program on Measurements

of Power in Male Collegiate Hockey Players. *J. Undergrad. Kin.Res 2006; 1(2):44-62.*

15. Craig, B.W. (2004) *What is the scientific basis of speed and agility? Strength and Conditioning* 26(3), 13-14.

16. Draper, J.A. and Lancaster, M.G. (1985) The 505 Test: A test for agility in the horizontal plane. *Australian Journal of Science and Medicine in Sport* 17, 15-18.

17. Harrison, A.J. and Gaffney, S. (2001) Motor development and gender effects on stretch-shortening cycle performance. *Journal of Science and Medicine in Sport* 4, 406-415.

18. Hennessy, L. and Kilty, J. (2001) Relationship of the stretch-shortening cycle to spring performance in trained female athletes. *Journal of Strength and Conditioning Research* 15, 326-331.

19. Hewett, T.E., Stroupe, A.L., Nance, T.A. and Noyes, F.R. (1996) Plyometric training in female athletes. Decreased impact forces and increased hamstring torques. *American Journal of Sports Medicine* 24, 765-773.

20. Holcomb, W.R., Lander, J.E., Rutland, R.M. and Wilson, G.D. (1996) A biomechanical analysis of the vertical jump and three modified plyometric depth jumps. *Journal of Strength and Conditioning Research* 10,, 83-88.

21. Komi, P.V. (1992) The stretch-shortening cycle. In: *Strength and power in sport*. Boston, Mass: Blackwell Scientific. 169-179.

22. Mayhew, J., Piper, F., Schwegler, T.M. and Ball, T.E. (1989). Contributions of speed, agility and body composition to anaerobic power measurements in college football players. *Journal of Applied Sports Science Research* 3, 101-106.

23. Michael G. Miller , Jeremy J. Herniman , Mark D. Ricard , Christopher C. Cheatham and Timothy J. Michael. The Effects Of A Six-Week Plyometric Training Program On Agility. *Journal of Sports Science and Medicine(2006) 5, 459-465.*

24. Michal Lehnert, IvonaLamrova, Milan Elfmark. Changes in Speed and Strength in Female Volleyball Players During and After a Plyometric Training Program.*ActaUniv, Palacki, Olomuc, Gymn. 2009 Vol 39, no.1.*

25. Miller, J.M., Hilbert, S.C. and Brown, L.E. (2001) Speed, quickness, and agility training for senior tennis players. *Strength and Conditioning* 23(5), 62-66.

26. Miller, M.G., Berry, D.C., Bullard, S. and Gilders, R. (2002) Comparisons of land-based and aquatic based plyometric programs during an 8-week training period. *Journal of Sports Rehabilitation* 11, 269-283.

27. Paasuke, M., Ereline, J. and Gapeyeva, H. (2001) Knee extensor muscle strength and vertical jumping performance characteristics in pre and postpubertal boys. *Pediatric Exercise Science* 13, 60-69.

28. Parsons, L.S. and Jones, M.T. (1998) Development of speed, agility and quickness for tennis athletes. *Strength and Conditioning* 20(3), 14-19.

29. Pauole, K., Madole, K. and Lacourse, M. (2000) Reliability and validity of the T-test as a measure of agility, leg power and leg speed in college aged men and women. *Journal of Strength and Conditioning Research* 14, 443-450.

30. Pfeiffer, R. (1999) Plyometrics in sports injury rehabilitation. *Athletic Therapy Today* 4(3), 5.

31. Piper, T.J. and Erdmann, L.D. (1998) A 4 step plyometric program. *Strength and Conditioning* 20(6), 72-73.

32. Potteiger, J.A., Lockwood, R.H., Haub, M.D., Dolezal, B.A., Alumzaini, K.S., Schroeder, J.M. and Zebas, C.J. (1999) Muscle power and fiber characteristic following 8 weeks of plyometric training. *Journal of Strength and Conditioning Research* 13, 275-279.

33. Read, M. (1996) An off-season strength and conditioning program for hockey. *Strength and Conditioning* 18(6), 36-39.

34. Renfro, G. (1999) Summer plyometric training for football and its effect on speed and agility. *Strength and Conditioning* 21(3), 42-44.

35. Robinson, B.M. and Owens, B. (2004) Five-week program to increase agility, speed, and power in the preparation phase of a yearly training plan. *Strength and Conditioning* 26(5), 30-35.

36. Roozen, M. (2004) Illinois agility test. *NSCA's Performance Training Journal* 3(5), 5-6.

37. Roper, R.L. (1998) Incorporating agility training and backward movement into a plyometric program. *Strength and Conditioning* 20 (4), 60-63.

38. Stone, M.H. and O'Bryant, H.S. (1984) Weight Training: A scientific approach. Minneapolis: Burgess.

39. Twist, P.W. and Benicky, D. (1996) Conditioning lateral movements for multi-sport athletes: Practical strength and quickness drills. *Strength and Conditioning* 18(5), 10-19.

40. Wathen, D. (1993) Literature review: explosive/plyometric exercises. *Strength and Conditioning* 15(3), 17-19.

41. Wilson, G.J., Newton, R.U., Murphy, A.J. and Humphries, B.J. (1993) The optimal training load for the development of dynamic athletic performance. *Medicine and Science in Sports and Exercise* 25, 1279-1286.

42. Yap, C.W. and Brown, L.E. (2000) Development of speed, agility, and quickness for the female soccer athlete. *Strength and Conditioning* 22,9-12

APPENDIX

8.1 ASSESSMENT PERFORMA

NAME :

AGE :

SEX :

SUBJECT NUMBER :

PSYCHOLOGICAL STATUS : GOOD / BAD

ANY CONTRAINDICATIONS:YES / NO

GROUP : Experimental / Control

DATA COLLECTION SCORE OF AGILITY

VARIABLE	AGILITY SCORE
T test	
Shuttle Run Test	
Lateral Change of Direction Test	

Guide Signature Student Signature Subject Signature

8.2 CONSENT FORM

I have been informed about the procedure and purpose of the study. I have understood that I have the right to refuse my consent or withdraw it any time during the study without adversely affecting my treatment.

I am aware that being subjected to this study I will have to give my time for assessment and treatment and these assessments do not interfere with the benefit.

I ----------, the undersigned give my consent to be a participant of this investigation / study program / clinical trail.

Signature of the Guide Signature of subject

(Name & Address)

8.3 MASTER CHART

T- Drill Test				
	Experimental Group		Control Group	
S No	Pre-Test Sec	Post-Ttest Sec	Pre-Test Sec	Post-Test Sec
1	11.98	11.57	12.39	12.43
2	12.41	12.16	12.69	12.6
3	11.69	11.15	11.7	12.12
4	12.52	12	12.79	12.9
5	11.91	11.35	12.32	12.12
6	11.82	11.53	11.82	11.72
7	12.31	11.98	12.55	12.4
8	11.91	11.75	13.12	13.3
9	12.46	11.99	11.92	12.25
10	11.67	11.39	11.76	12.18
11	11.52	11.24	12.4	12.69
12	11.74	11.49	11.99	12.43
13	12.45	12	11.91	12.17
14	11.63	11.25	11.69	11.9
15	11.99	11.73	11.73	11.99
Mean	12	11.64	12.19	12.35

MASTER CHART				
Shuttle Run Test				
	Experimental Group		**Control Group**	
S No	**Pre-Test Sec**	**Post-Ttest Sec**	**Pre-Test Sec**	**Post-Test Sec**
1	9.52	9.4	9.72	9.75
2	9.68	9.55	9.74	9.69
3	9.8	9.67	9.9	9.84
4	9.61	9.46	9.83	9.9
5	9.77	9.58	9.43	9.54
6	9.92	9.75	9.93	9.9
7	9.95	9.82	9.91	9.95
8	9.73	9.54	9.84	9.9
9	9.88	9.67	9.69	9.95
10	9.61	9.43	9.63	9.79
11	9.52	9.27	9.78	9.97
12	9.63	9.38	9.54	9.94
13	9.81	9.54	9.67	9.98
14	9.95	9.59	9.73	9.79
15	9.88	9.66	9.77	9.93
Mean	9.75	9.55	9.74	9.85

MASTER CHART				
Lateral Change of Direction Test				
	Experimental Group		**Control Group**	
S No	**Pre-Test Sec**	**Post-Ttest Sec**	**Pre-Test Sec**	**Post-Test Sec**
1	6.3	6.06	6.4	6.38
2	6.56	6.44	6.66	6.8
3	6.48	6.36	6.62	6.68
4	6.21	6.09	6.48	6.69
5	6.42	6.25	6.82	6.93
6	6.55	6.32	6.91	6.94
7	6.75	6.28	6.72	6.88
8	6.82	6.41	6.6	6.9
9	6.66	6.3	6.93	6.99
10	6.77	6.29	6.87	6.96
11	6.57	6.11	6.77	6.9
12	6.38	6.19	6.95	7.12
13	6.46	6.22	6.97	7.22
14	6.87	6.61	6.99	7.18
15	6.91	6.75	6.63	7.2
Mean	6.58	6.31	6.75	6.92