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Effect of psycho-physiotherapeutic approach in enhancing performance among elite archers

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Abstract
Background of Study: Archery is a game of precision and focus. Pre-competition anxiety and stress decreases the focus as well as concentration in archers. Furthermore, the irregularities in shoulder strength training program during training sessions will influence their performance. Thus, the purpose of the present study is to determine the effect of Psychological Skill Training program along with Strength Training of shoulder stabilizers in enhancing the performance in elite archers.
Method: Elite archers (n=30) were screened on the basis of inclusion and exclusion criteria. The subjects were allocated using Simple Random Sampling Method into Experimental and Control Group. The treatment protocol was administered on experimental group which consists of psychological skill training along with strength training of shoulder stabilizers and in Control group only conventional training program given by their coaches were administered. Baseline and Post-Intervention data was collected using MIQ-R, Bull's MSQ, SCAT, AAPHER and Digital Strain Gauge.
Results: The Results of the present study indicate that there was significant increase in the performance of elite archers in the Experimental Group than in Control Group. There was significant improvement in MIQ-R, Bull's MSQ, SCAT, AAPHER and Digital Strain Gauge.
Conclusion: It has been concluded that Psychological Skill Training along with Strength Training of Shoulder Stabilizers plays a major role in enhancing performance of elite archers by improving their mental skills and self confidence, decreasing pre-competition anxiety and increasing the strength of shoulder stabilizers.

Keywords: Elite, performance, psychological skill training, mental skills

Introduction
Archery is an individual and non-contact, static sports that requires archer to possess muscular strength, upper body endurance, coordination, attention, concentration and high levels of stability with proper precision and focus [1]. Shooting in archery requires not only physical training but also high level of mental concentration, focus and coordination [2]. Archery skills are affected by many factors and an increased performance level can only be achieved by working on all these major factors. These factors are attention and concentration span, mental toughness, pre competition anxiety, ability to learn sports specific skills and strengthening of shoulder stabilizers [3].
As the archer performs drawing, anchoring, loading, aiming and expansion, it is required that he should be précised and focus with each shot. In Archery, the drawing and releasing phase requires adequate strength of shoulder stabilizers especially deltoid, latissimus dorsi, rhomboids and trapezius muscle [4]. Therefore to improve performance during competition an elite archer not only requires mental skills but also strength and endurance of shoulder stabilizers.
Psychological skill training is a systematic educational program designed to help coach and his athlete to acquire and practice mental skills with the aim to enhance their performance in sports [5]. These Program aims at decreasing pre-competition stress and anxiety, promoting general body relaxation and mental toughness, enhancing attention and concentration which exerts positive influence on their performance and their sports specific skill learning [6]. The various components of Psychological Skill Training are Mental Imagery, Modified Jacobson's Progressive Relaxation Technique, Rational Emotive Behaviour Therapy and Attention Control Techniques.

Mental Imagery forms basis of Psychological Skill Training and is the involuntary creation or recreation of an experience generated from memorial information, involving quasi sensorial, quasi perceptional and quasi-affective characteristics which may occur in the absence of the real stimulus [7]. It is used to improve mental toughness as well as enhance self confidence and skill acquisition. Modified Jacobson's Progressive Relaxation Technique is the second component of psychological skill training program, it involves alternate contraction and relaxation of specific group of muscles. It promotes general relaxation of body and facilitates recovery from fatigue [8]. The third component of Psychological Skill Training is Rational Emotive Behaviour Therapy, it is used to reduce pre-competition anxiety and stress by changing irrational beliefs into rational thinking through regular counseling sessions and behavior modification [9]. The fourth component of Psychological Skill Training is Attention Control Techniques, it is used to control attention span through thought stop and positive self-talk with negative cues and distractions techniques [10].

In previous studies, it has been documented that great deal of research was done to address efficacy of psychological skills training program in enhancing mental skills among football players, basketball players, golfers and gymnasts but its role in archery has been less documented [11]. Furthermore, it has been observed that the physical training program tailored by the coaches involves general body warm up and stretching whereas the strength training of the primary draw muscles required during shooting an arrow was neglected.

So, the present study was done to analyze the effectiveness of Psychological Skill Training Program along with Strength Training of shoulder stabilizers in enhancing performance among elite archers.

Methodology

The present study is Randomized Control Trial (RCT) in nature in which efficacy of Psychological Skill Training along with Strength Training of shoulder stabilizers in enhancing the performance of elite archers is determined. The sample consists of 30 elite archers out of which 17 were females and 13 were males of mean age 21.93 ± 1.22 years. They were selected on the basis of inclusion and exclusion criteria. Upon clinical exam, the inclusion criteria were (1) Age group 18-25 years (2) Both male and female players (3) Subjects who are cooperative and will participate voluntarily in study (4) Elite archers who have played at National and International Level (5) More than one year experience with the team (5) Archers without upper limb injuries since past 1 year (6) Archery category- Recurve or Compound.

The exclusion criteria were Archers < 17 years of age, subjects who are uncooperative, archers playing below the National Level, archers having history of musculoskeletal injury and pathology of upper limb in past 6 months and any recent surgery for upper limb in last 1 year. Simple Random Sampling Method was used to in which subjects were randomly allocated in Experimental and Control Groups by flipping the coin. Subjects were explained the nature of the study and written consent was obtained from them.

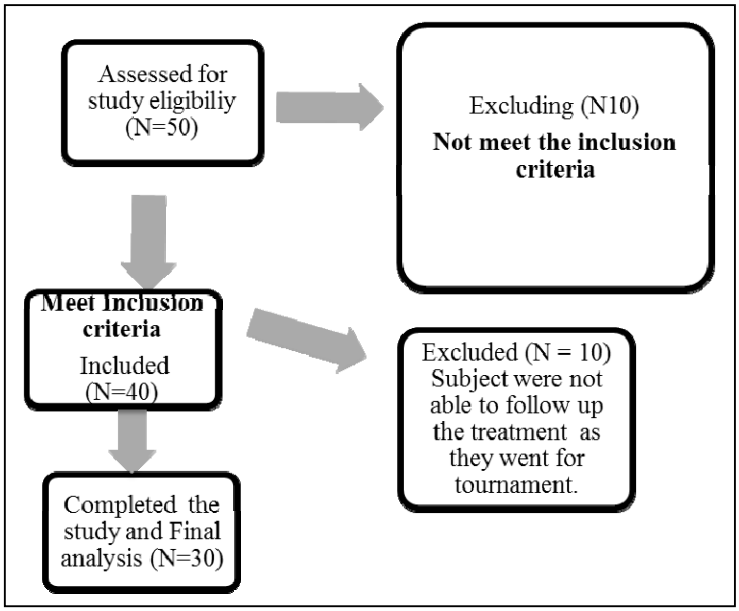


Fig 1: Consort Diagram for the subjects included in the study

Outcome Measures

5 primary outcome measures were used in the study: Revised Movement Imagery Questionnaire (MIQ-R), Bull Mental Skill Questionnaire (Bull's MSQ), Sports Competitive Anxiety Test (SCAT), Archery Performance Scoring (AAPHER) and Digital Strain Gauge. All measures were obtained at Baseline, 21 days after implementation of intervention and after 42 days of implementation of intervention. The MIQ-R is an 8-item self-report inventory designed to assess visual and kinesthetic imagery ability. Participants were asked to assume a starting position and then instructed to perform one of four simple motor movements. They were then instructed to reassume the starting position and then either "see" or "feel" them self performing the movement without actually doing that movement they performed before. Participants then assign a value from a 7-point scale, which indicates the ease or difficulty with which the movement was seen/felt. Responses were summed per scale, thereby resulting in two scores, one for visual imagery ability and one for kinesthetic imagery ability [12]. The MIQ-R has been studied extensively and determined to be used as valid and reliable instrument that is responsive to change [13].

The modified Bull's Mental Skill Questionnaire (Bull's MSQ) comprised of five subscales: imagery ability, mental

preparation, self-confidence, concentration and activation regulation. The questionnaire has 20 items and assesses participants along a 5-point Likert scale, requiring item responses ranging from "always" to "never". Score Interpretation: The highest possible score is 100, whereas lowest possible score is 20. 70 or higher score interprets high mental toughness and mental skills, score ranging from 50-70 indicates moderate level of mental toughness and mental skills whereas score ranging 50 or under interprets low level of mental toughness and skill [14]. The Bull's MSQ has been studied extensively and determined to be used as valid and reliable instrument that is responsive to change [15].

Sports Competition Anxiety Test (SCAT) measures competition trait anxiety. It consists of 15, three point Likert-type Questions with answers ranging from "hardly ever" to "often". The score ranges from 10-30 representing low to high competitive anxiety respectively. The SCAT has been studied extensively and determined to be used as valid and reliable instrument that is responsive to change [16].

Archery Performance Scoring (AAPHER) is used to evaluate the performance of the archers. Target originally is at distance of 10 yards, 20 yards and 30 yards for compound and 50 yards for recurve from the shooting line but for the uniformity of the data, the distance chosen for all the archers was 50 meters for scoring. Each tester was given 4 practice shots. Each archer was asked to shoot total of 12 arrows (2 rounds of 6 arrows each). The arrow which hit in the innermost circle, got 9 points followed by 7, 5, 3 and 1 point respectively for the arrows hitting the respective circles outside the innermost circle. The sum of score of 12 arrows was then taken as the score of performance. AAPHER has been studied extensively and determined to be used as valid and reliable instrument that is responsive to change [17].

Digital Strain Gauge is a device whose resistance varies in proportion to the amount of strain produced in the device with consistent contraction of muscle whose strength is being measured.

Sample Size Determination

A prior power analysis demonstrated the need of 30 subjects per group, given a standard deviation of 0.9 mm (AAPHER), a difference in scoring, between groups of 0.6mm on AAPHER, an alpha level of 1.96, and a power set of 80%.

Procedure

The subjects were assessed before the beginning of the treatment and were allocated randomly into two groups and Baseline evaluation on various outcome measures like MIQ-R, Bull's MSQ, SCAT, AAPHER and strain gauge was taken. The treatment protocol was administered on experimental group (Group A) for 1 hour per day for 5 days for 6weeks, which consists of psychological skill training combined with strength training of shoulder stabilizers and in control group (Group B) only conventional training program given by their coaches were administered.

Psychological Skill Training consists of Mental Imagery, Modified Jacobson's Progressive Relaxation Technique, Rational Emotive Behavior Therapy and Attention Control Techniques which was administered in morning sessions in subjects of Experimental Group. Firstly in PST, the Mental Imagery component was used in which the subject was asked to imagine the pre-competition sight. Secondly, Modified Jacobson's Progressive Relaxation Technique was used in which the subject was asked to alternately contract and relaxes each muscle group from head to toe. Thirdly, Rational Emotive Behaviour Therapy was used in which counseling of subject was done by changing irrational beliefs associated with competition to rational beliefs. Lastly, Attentional Control Techniques was used to recognize broad and narrow attention span. Positive self talk with negative cues and distraction was practiced of the same day, in the evening session the Strength Training Program included warm-up and strengthening exercise for shoulder stabilizers were administered. In strength training program, the Warm-up routine consists of 20 minutes running, walking and stretching of muscles involved in shooting of arrow i.e. deltoid, trapezius, latissimus dorsi and rhomboids were administered. Strength Training of shoulder flexors, extensors, abductors, retractors, medial and lateral rotators was done with dumbbells. The Exercises were Side Raise, Front Raise, Back Raise, Military Press, Upright Row, Shrugs and Single Arm Rows, Side lying Internal and External Rotation. Post Intervention data was collected on 21st and 42nd day of administration of interventions.

The subjects of the Control Group (Group B) were observed as they underwent the usual conventional training program which includes warm-up and bow training tailored by coach. Baseline data was collected on Day 1whereas Post Intervention data was collected on 21st and 42nd day of the Intervention using MIQ-R, Bull's MSQ, SCAT and AAPHER whereas strength of shoulder stabilizers is measured by using strain gauge.

Results

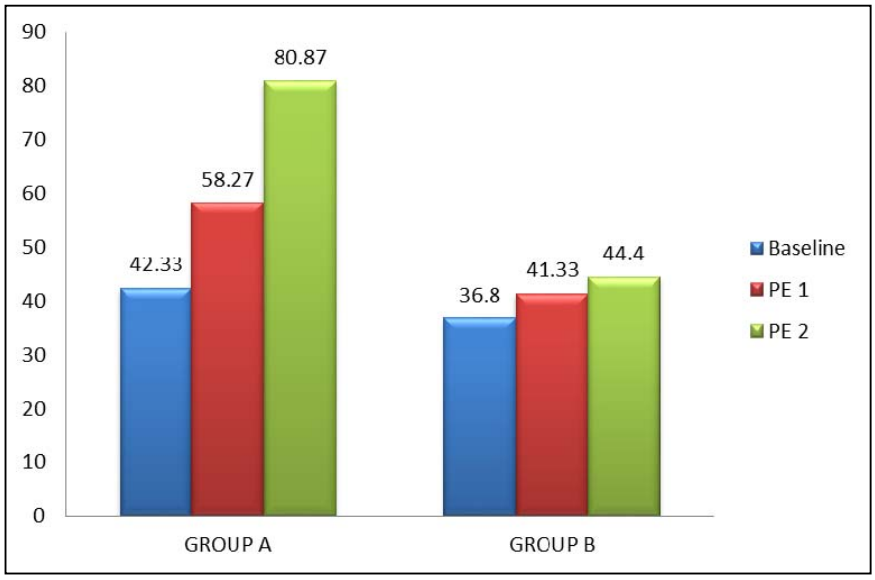
The Experimental Group showed immediate changes in all the outcome measures indicating the positive effect of the interventions administered. The Mean Value of MIQ-R of Baseline Vs 21st day Vs 42nd day for Group A was 12.93 ± 2.55 and 13.47 ± 2.88 respectively, which showed that there was significant improvement in imagery ability in subjects of Experimental Group then in Control Group. It was also found, that there was significant mean value between SCAT score at Baseline Vs 21st day Vs 42nd day within the Group A (Experimental) which was 50.041. In Group B (Control), there was no change in the score between baseline and post-intervention evaluation.

The Mean Value Score of Bull's MSQ at Baseline Vs 21st day Vs 42nd day for Group A and B was 50.841 and 0.932 respectively, which showed that there was significant improvement in general relaxation and attention control of archers. The significant improvement in mean value score of strength of shoulder flexors, extensors, adductors, abductors, medial rotators, lateral rotators and retractors at Baseline Vs 21st day Vs 42nd day is shown in fig 2.

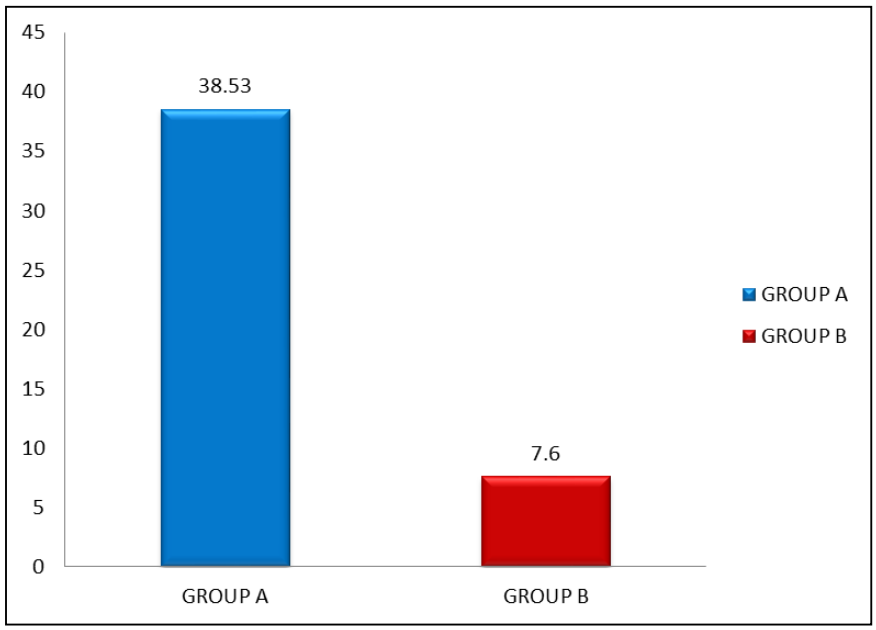
		Group A		Group B	
		Left	**Right**	**Left**	**Right**
1.	Shoulder Flexors	54.330	53.551	3.418	1.939
2.	Shoulder Extensors	40.117	42.741	1.568	1.458
3.	Shoulder Abductors	34.952	35.291	0.924	0.722
4.	Shoulder Adductors	10.892	7.258	0.973	0.715
5.	Medial Rotators	45.291	39.038	1.591	1.380
6.	Lateral Rotators	49.595	46.499	1.718	1.722
7.	Retractors	39.630	36.278	1.087	1.011

Fig 2: Mean Value Scores of Strength of Shoulder Stabilizers at Baseline, 21st day and 42nd day of Group A and B

The Mean Value Score of Archery Performance Scoring (AAPHER) at Baseline Vs 21st day Vs 42nd day for Group A and B was 56.969 and 3.670 respectively as shown in Graph 1. It means there was significant improvement in performance of subjects in Group A then in Group B as shown in Graph 1.



Graph 1: Shows Comparison of Mean value of AAPHER at Baseline, 21st day (PE 1) and 42nd day (PE2) between Group A and B



Graph 2: Shows comparison of improvement of AAPHER between Group A and B

Discussion

The purpose of this study was to analyze the effect of Psychological Skill Training along with Strength Training of shoulder stabilizers to enhance the performance of elite archer. Our results are partially consistent with previous reports showing consistent with previous reports that integrated approach consisting of Psychological Skill Training all with strength training of shoulder stabilizers have a positive effect in enhancing performance of elite archers in comparison with conventional training by increasing mental toughness and skill acquisition, improving self confidence and attention control, decreasing pre-competition anxiety and increasing strength of shoulder stabilizers [18, 3].

Mental Imagery is the manner in which people imagine themselves in a way that can lead to learning and development of skills and can facilitate performance [19]. In the present study Movement Imagery Questionnaire-R (MIQ-R) was used, as the outcome measure to assess visual and kinesthetic imagery ability of the archers. It was found that Mental Imagery shows significant results among archers and show improvements in imagery ability, skill acquisition, self confidence and mental toughness [20]. In the present study, 6 weeks imagery training program was given to the archers which was in contrast to previous studies which reported 16 week imagery training program is required to improve imagery ability and skill acquisition [21].

In the present study, Rational Emotive Behaviour Therapy (REBT) was used as subcomponent of Psychological Skill Training, which effect on decreasing pre-competition anxiety assessed by Sports Competitive Anxiety Test (SCAT). It was established that Rational Emotive Behaviour Therapy shows significant effect among archers leading to decrease in pre competition anxiety [9, 22]. In the present study, REBT attributed to reduce pre competition anxiety by changing irrational beliefs to rational thinking but its effect in enhancing the performance in sports was not established.

Modified-Jacobsons Progressive Relaxation and Attention Control Strategies were used as subcomponent of

Psychological Skill Training. In the present study, Bull's Mental Skill Questionnaire (Bull's MSQ) was used to measure the effect of Modified- JPRT and attentional control strategies in improving general relaxation and attention control span. The result of the present findings were in consistent with previous studies which reported that the performance of the player was enhanced when mental imagery was practiced along with M-JPRT in their training schedule [23].

Strength Training Program is type of physical exercise done by using various equipments like theraband, dumbbells, sand bags and rubber tubings to induce muscular contraction which builds the strength, anaerobic endurance and increase size of skeletal muscles. The aim of strength training program in archery is to increase muscle strength and endurance of the muscles involved to stabilize the bow and shoot an arrow. In the present study, for strength measurement from the strain gauge and AAPHER Archery Performance Scoring was used as outcome measure.

It was established that there was significant improvement in shoulder stabilizers of the subjects of Group A then in Group B leading to increase in AAPHER score. The result of the present findings were in consistent with previous studies which reported that strength training of muscles of shoulder and upper back, enhances the archery performance by increasing arm-hand steadiness i.e. ability to maintain the arm-hand in fixed position so as to execute a smooth movement. To achieve this strength training of shoulder stabilizers was included in the protocol to enhance performance level [24].

Future study can be done on large sample size and comparison on efficacy of interventions on both males and females can be made. Follow-up study can be made to determine the long term effects of Psychological Skill Training.

Conclusion

It has been concluded that Psychological Skill Training along with Strength Training of shoulder stabilizers plays a major role in enhancing the performance of elite archer by increasing mental toughness and skill acquisition, decreasing pre-competition anxiety, improving self-confidence and general body relaxation, and increasing attention control span and strength of shoulder stabilizers.

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