



## INFLUENCE OF SQUAT EXERCISES ON FLEXIBILITY AND CORE STRENGTH AMONG SCHOOL KHO-KHO PLAYERS

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**Abstract:** The purpose of the study was to find out the influence of squat exercises on flexibility and core strength among school kho-kho players. To achieve the purpose of the study thirty school kho-kho players were selected randomly as subjects from various schools in Tirunelveli District, Tamilnadu, India and their age were ranged from 15 to 17 years. The school kho-kho players were assigned at random into two groups of each fifteen (N=15). Group-I underwent squat exercises and Group-II acted as control group who did not attended any special training other than their daily school schedule curriculum. The duration of the training period was restricted to six week for three alternative days per week. The pre and post tests data were collected before and after the training period. The dependent variables flexibility and core strength were tested by standardized test items sit & reach and plank tests respectively. The collected data from the two groups prior to and after the experimental treatments on selected variables flexibility and core strength were statistically analyzed by using dependent 't' test and analysis of covariance (ANCOVA). In all the cases the level of confidence was fixed at 0.05 significant. The result of the study indicated that the experimental group had shown significantly improved in flexibility and core strength among school kho-kho players due to the influence of squat exercises. However the control group did not shown any significant improvement on selected variables such as flexibility and core strength.

**Keywords:** Squat Exercise, Flexibility, Core Strength, Sit & Reach Test, Plank Test

### 1. Introduction

Squats are one of the best exercises for building lower body strength and sculpting hamstrings, abdominal and quadriceps [1]. It helps to improve pain-free mobility and flexibility by encouraging full extension and contraction throughout the hips. In strength training and fitness, the squat exercises that trains the muscles of

the thighs, hips and buttocks, quadriceps femoris, hamstrings, as well as strengthening the bones, ligaments and insertion of the tendons throughout the lower body [2], [3] & [4]. Squats are considered vital exercises for increasing the strength and size of the muscles as well as developing core strength. The lower back, the upper back, the abdominals, the trunk muscles, the costal muscles, the shoulders and arms are all essential to the exercise and thus are trained when squatting with the proper form [5 & 6]. Core strength is the foundation of the Pilates method of exercise. The core muscles are the deep, internal muscles of the abdomen, back, and pelvic floor [7]. The own body and apparatus squat exercises are one of the three lifts in the strength sport of power lifting, together with dead lifts and bench press [8].

The Kho-Kho game is an Indian sport commonly played in schools and colleges in our country. The history of kho-Kho, was known to be played since the earliest of times [9]. Kho-Kho is a great sport of the participants` physical fitness, strength, speed, flexibility, core strength, stamina and dodging ability [10]. In the ancient era, a version of the Kho-Kho game was played on `raths` or chariots in Maharashtra. This was known as RATHERA. The Kho-Kho rules were first framed in the early 1900's this study was motivation and control of the player fitness level improvement of sports agility higher performances [11] & [12].

### 2. Purpose of the Study

The purpose of this study was to find out the influence of squat exercises on flexibility and core strength among school kho-kho players.

### 3. Methodology

The purpose of the study was to find out the influence of squat exercises on flexibility and core strength among school kho-kho players. To achieve the purpose of the study thirty school kho-kho players were selected randomly as subjects from various schools in Tirunelveli District, Tamilnadu, India and their age were ranged from 15 to 17 years. The selected subjects were

assigned at random into two groups of fifteen (N=15) each. Group-I underwent squat exercises and Group-II acted as control group who did not attended any special training other than their regular daily school schedule curriculum. The duration of the training period was restricted to six week for three alternative days per week. The pre and post tests data were collected before and after the training period. The dependent variables flexibility and core strength were tested by standardized tests items sit & reach and plank tests respectively.

3.1 Analysis of the Data

The influence of squats exercises on flexibility and core strength among school kho-kho players were analyzed and presented below.

3.1.1 Flexibility

The mean value of t-test on flexibility (sit & reach test) of pre and posttests scores of squat exercises and control groups have been analyzed and presented in table 1.

Table1: The Mean Value of Pre and Post Tests Scores of Experimental and Control Groups on Flexibility (In Centimeters)

Group	Pre Mean	Post Mean	Mean difference	Obtained t-ratio
Squat Exercise Group	22.18	29.41	7.23	11.08*
±SD	2.07	1.78		
Control Group	22.09	22.15	0.06	1.07
±SD	1.27	1.24		

\*Significant at .05 level. (The table value required for 0.05 level of significance with df 14 is 2.14)

The table 1 show that the pre-test mean value of squat exercises and control groups are 22.18 and 22.09 respectively and the posttest means are 29.41 and 22.15 respectively. The obtained dependent t-ratio values between the pre and posttests means of squat exercises and control groups are 11.08 and 1.07 respectively. The table value required for significant difference with df 1 and 14 at 0.05 level is 2.14. Since, the obtained 't' ratio value of squat exercises group was greater than the table value, it is understood that squat exercises group had significantly improved on flexibility. However, the control group had not improved significantly. The 'obtained t' value is less than the table value, as they were not subjected to any specific training.

Analysis of covariance (ANCOVA) on flexibility of experimental and control groups have been analyzed and presented in table 2.

Table 2: Analysis of Covariance (ANCOVA) on Flexibility of Experimental Group and Control Groups

*APTm		*SV	*SS	df	*MS	F ratio
EG	CG	B	61.21	1	61.21	13.39*
28.96	22.35	W	123.39	27	4.57	

\*Significant at 0.05 level. (The table value required for significance at 0.05 levels with df 1 and 27 is 4.21)

\*Adjusted Posttest Mean (APTm), Sum of Variance, Sum of Square (SS), Mean of Square (MS)

Table 2 shows that the adjusted posttest mean value on flexibility of squat exercises and control groups are 28.96 and 22.35 respectively. The obtained f- ratio 13.39 for adjusted posttest mean is greater than the table value 4.21 with df 1 and 27 required for significance at 0.05 level of confidence. The result of the study indicates that there was significant difference exist between the adjusted posttest mean of squat exercises and control groups on flexibility.

The bar diagram shows the mean values of pre, post and adjusted post tests on flexibility of squat exercises and control groups

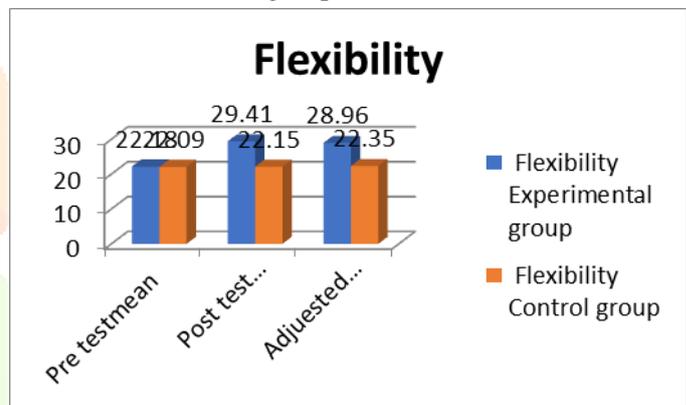


Fig. 1. pre, post and adjusted post tests mean values of squat exercises and control groups on flexibility (sit & reach test in centimeters).

3.1.2 Core Strength

The mean value of t-test on core strength (Plank test) of pre and post tests scores of squat exercises and control groups have been analysed and presented in table3.

Table 3: the pre and post tests scores of squat exercises and control groups on core strength (in seconds)

Group	Pre Mean	Post Mean	Mean difference	Obtained t-ratio
Squat Exercise Group	36.42	53.46	17.04	17.33*
±SD	2.98	2.76		
Control Group	36.01	36.25	0.24	1.53
±SD	2.71	2.73		

\*Significant at .05 level. (The table value required for 0.05 level of significance with df 14 is 2.14)

The table 3 shows that the pre-test mean value of squat exercises and control groups are 36.42 and 36.01 respectively and the post test means are 53.46 and 36.25 respectively. The obtained dependent t-ratio values between the pre and posttests means of squat exercises and control groups are 17.33 and 1.53 respectively. The table value required for significant difference with df 1 and 14 at 0.05 level is 2.14. Since, the obtained 't' ratio value of squat exercises group was greater than the table value, it is understood that squat exercises group had significantly improved the core strength. However, the control group had not improved significantly. The 'obtained t' value is less than the table value, as they were not subjected to any specific training.

Analysis of covariance (ANCOVA) on core strength of experimental and control groups have been analyzed and presented in table 4.

Table 4: Analysis of Covariance (ANCOVA) on Core Strength Test of Experimental and Control Groups

*APT M		*SV	*SS	df	*MS	F ratio
EG	CG	B	67.52	1	67.52	51.94*
54.62	36.29	W	35.1	27	1.30	

\* Significant at 0.05 level. (The table value required for significance at 0.05 levels with df 1 and 27 is 4.21)

\*Adjusted Posttest Mean (APT M), Sum of Variance, Sum of Square (SS), Mean of Square (MS)

Table 4 shows that the adjusted posttest mean value on core strength of squat exercises and control groups are 54.62 and 36.29 respectively. The obtained f-ratio 51.94 for adjusted posttest mean is greater than the table value 4.21 with df 1 and 27 required for significance at 0.05 level of confidence. The result of the study indicates that there was significant difference exist between the adjusted posttest mean of squat exercises and control groups on core strength.

The bar diagram shows the mean values of pre, post and adjusted post tests on core strength of squat exercises and control groups

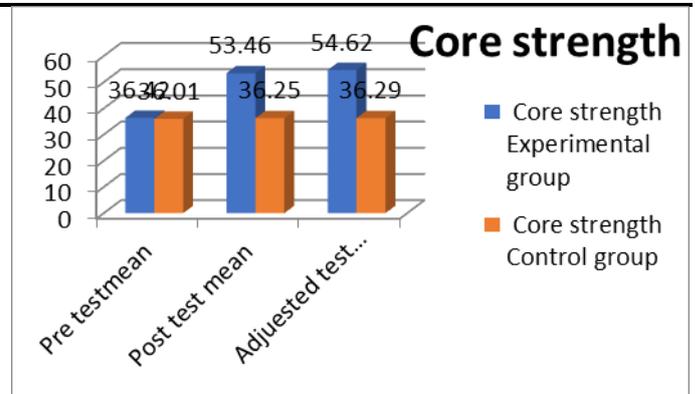


Fig. 2; pre, post and adjusted post tests mean values of squat exercises and control groups on core strength (plank test in seconds)

#### 4 Discussions on Findings

The intent of this study was to investigate the squat exercises of school kho-kho players with respect to the orientation on flexibility and core strength. The results of this study shown that kho-kho players were significantly improved on flexibility and core strength due to the effect of squat exercises training when compare to the control group. Willson, J.D., Ireland, M.L., & Davis, I. (2006), and Stickler, L., Finley, M., & Gulgin, H. (2015), studies proved the same results for the improvement on core strength and Dallas, G., Kirialanis, P., & Mellos, V. (2014) and Adams, K., O'shea, P., & O'shea, K. L. (1999) Studies also proved significant improvement on flexibility. S.Arumugam (2014) conducted study on Pilates training and study proved improvement on flexibility and core strength.

#### 5 Conclusions

1. There was significant improvement on core strength due to the influence of squat exercises among school kho-kho players.
2. There was significant improvement on flexibility due to the influence of squat exercises among school kho-kho players.
3. However the control group had not shown any significant improvement on any of the selected variables.

#### Acknowledgement

I acknowledge sincere gratitude to my guide who support and guided in a proper way. I would like to place my sincere thanks to the Department of physical Education; Manonmaniam Sundaranar University provided study supportive materials. Also I express my sincere thanks to the volunteers of this study.

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