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Effect of Training on Muscular Strength, Flexibility and Agility in Judo Players: A Comparative Study

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Abstract

Background: Judo is a dynamic and tremendous combat sport that demands both physical prowess and great mental discipline. Maximal muscle strength is ultimate strength value under static conditions. Flexibility is defined as the maximal passive physiological range of motion in a given joint movement. Agility is the ability to move the body in order to change directions quickly and accurately. *Objective:* To compare muscular strength, flexibility and agility levels of judo players with age matched sedentary first year MBBS students and understand the effect of training on these parameters. *Material and methods:* For this study, 31 judo players and 31 sedentary MBBS students as controls were included. Muscular strength was assessed by 1 repetition maximum (1RM) Bench press and bench squat, flexibility by sit and reach tester and agility by side step test. Students unpaired 't' test used for analysis. *Results:* Unpaired t-test With $p<0.05$ significance was applied for values expressed as Mean ± SD, all the parameters muscle strength, flexibility and agility levels were higher in judo player group with statistically significant difference. *Conclusion:* There is significant effect seen due to training on the parameters in judo players which can be understood better and help in formulating techniques during training sessions to get better results from players.

Keywords: Muscle Strength; Repetition Maximum; Flexibility; Agility; Side Step Test; Sit and Reach Test.

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Introduction

Judo is a popular contact sport, in which powerful movements are given in short duration of time against opponent's force [1]. Success in judo competition involves high level of physical training, tactics and techniques. Judo training programmes should not only focus on applied training loads but also on strengthening physiological abilities like cardiovascular endurance, muscular strength, flexibility and agility.

In most of the sports, efficient muscle strength plays a role in improvement of players performance. Maximal muscle strength is defined as a peak strength value under static conditions [2]. Flexibility is defined as the maximal passive physiological range of motion in a given joint movement. More flexible the muscle, more is the range of motion in different parts of the body and less chances of injury during the game [3]. Agility is the ability to change direction rapidly and smooth. Judo players will need good agility to perform complicated sequences of techniques like combinations, counters and other linking skills defensive or offensive.

Judo as a sport is not well known in India, Efforts to improve the standards of our Judokas are in process. In this view this study was undertaken to scientifically contribute to assessment of the muscular strength, flexibility and agility levels of Indian Judokas and compare with controls to understand the changes in these parameters due to training sessions which will help the coaches to design the training program for betterment of the players.

Objectives

To compare muscular strength, flexibility and agility levels of judo players with age matched sedentary first year MBBS students and understand the effect of training on these parameters.

Materials and Methods

This cross sectional study included 31 judo players based on universal sampling method i.e all the number of judo players available at the time of data collection and who fit into our inclusion criteria were considered.

Inclusion Criteria

Players within the age group of 18-25 years with minimum three years of training in the sport and 31 age matched MBBS students belonged to first MBBS class as controls.

Exclusion Criteria

Judo players with history of any cardiac, respiratory, neuromuscular, endocrine disorders or history of taking drugs, medication, or supplements. Control students who practiced exercise regime were excluded.

This study was approved by Institutional ethical committee and informed consent was taken from the participants after describing the nature of the study.

Muscular Strength

Strength is defined as the maximum effort muscular force that can be exerted against resistance. Measured using one repetition maximum (1RM) bench press and bench squat performed using free weights.

Bench Press Test- 1 RM

Participant was asked to lie in supine position on the bench. Weight lifting bar was placed in the hands of participant across the chest with basic weights. The participant extended his arms pressing the bar with elbow in straight position. Bar was removed after completion of test and weight was noted. A second trial with an added weight was tried. The best score of the two trials was recorded and then divided by his body weight which gave the score of the test.

Bench Squat test-1 RM:

Bar with weights was placed on the shoulders of the participant as he stands at the edge of the bench. With the feet apart and firm hold on the bar with hands participant lowered to an erect sitting position on the bench such that greater trochanter was lowered to the same level as the knee, then the participant returned to the standing position without to and fro movements and removed weight. Similar second trail was performed with increased weights. The best score of the two trials was recorded and then divided by his body weight which gave the score of the test [4,5].

Flexibility was tested using Sit and Reach flexibility Tester. Participant was made to sit on the floor with legs stretched out straight ahead and toes pointed upwards. The soles of the feet were placed flat against the centre limbs of the tester. Both knees were locked and pressed flat to the floor by the examiner. With both hands on top of each other and palms facing downwards participant reached forward as far as possible along the measuring line with smooth movement, bouncing or lunging was not allowed. After adequate practice, participant reached out and held that position for two seconds while the distance was recorded. Distance reached by the hand was taken as test score.

Agility was assessed by side step test where we drew lines accordingly as shown in the figure 1 on the plane ground. A centre line was drawn on the ground,two lines 3 feet and 6 feet apart from the centre line were drawn using a measuring tape on either side. Starting from the position on the centre line. The participant side stepped on the signal went to the right until his foot had touched the outside line to the right. Then side stepped to the left until his left foot had touched the outside line to the left. Participant repeated these movements as rapidly as possible for 10 seconds.

Scoring One foot tick mark placed between center line and outside line, each trip from center line across marker counts as follows: moving across right crosses tick [1], outside line to right

(2), then back tick (3), center (4), across left tick (5), outside line to left (6), back tick (7) and center (8). One completed cycle gives a score of eight points. Total score within ten seconds was taken [4,5,6,7]. Statistical analysis involved quantitative variables summarized through mean and standard deviation. Difference between mean of the two groups was tested using Students unpaired 't' test, where significance of the p value was < 0.05.

Flexibility and Agility Scores

Table 2 shows that Sit and Reach test mean score for flexibility testing was much higher in judo players (18.1) than the controls (0.03) and this difference was statistically significant ($p < 0.05$) Agility testing using side step test score was high for judo players (30.8) and controls (23.6) and the difference was significant statistically ($p<0.05$).

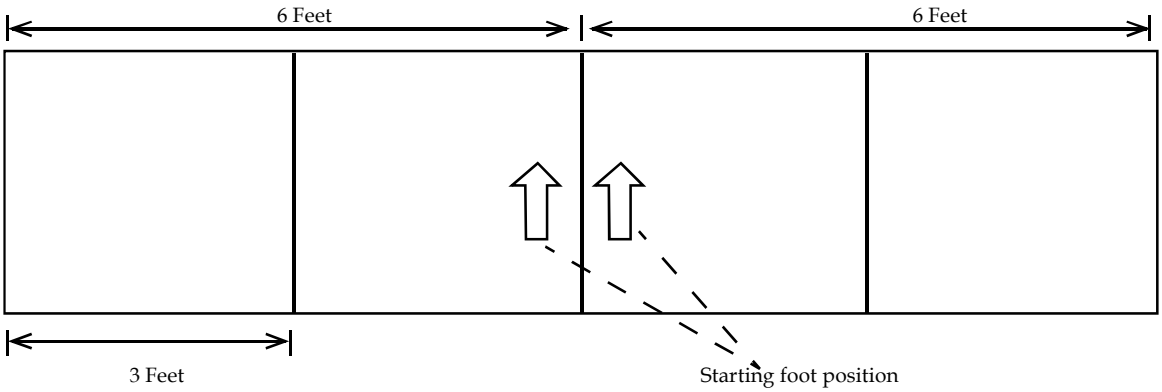

Fig. 1: Showing measurement of side step test marking to be drawn

Results

This study was done on total 62 participants Mean age of our participants in judo group was 20.1 whereas in control group it was 18.7years. Mean height and weight for Judo group was 163 cms and 61 kgs respectively for control group 168 cms and 63kgs respectively.

Muscular Strength among Judo and Controls

Table 1 shows one repetition maximum for bench press and bench squat, weight pushed and the score for both the test was higher in Judo players than the control and the difference was statistically significant ($p <0.05$).

Table 1: Comparison of muscular strength among Judo and controls

		Judo	Controls	p Value
Bench	Weight pushed	62.9 ± 19.31	43.3 ± 14.05	0.000*
press	Score	0.97 ± 0.41	0.67 ± 0.17	0.000*
Bench	weight pushed	114.4 ± 28.11	60.1 ± 20.64	0.000*
squat	Score	1.90 ± 0.50	0.93 ± 0.23	0.000*

(*) p value significance < 0.05

Table 2: Flexibility and Agility test scores compared among Judo and controls

	Judo	Controls	p Value
Flexibility test score	18.1 ± 3.95	0.03 ± 4.88	0.000*
Agility test Score	30.8 ± 3.96	23.6 ± 4.85	0.000*

(*) p value significance < 0.05

Discussion

In our study there was significant difference in muscular strength between player and the control group suggests that the players are exposed to sufficient muscle strengthening and conditioning exercises in their training program. Muscular strength is the capability of muscles to generate maximal contractile forces against resistance in a single contraction (Most common method to determine strength is to determine how much an individual can lift in one repetition maximum (1RM). In Judo as sport muscular strength plays a vital role as judo involves disbalancing the opponent in first phase (Kuzushi) second phase where body contact is made with opponent and semi squat position is attained (tsukuri) and the throw phase where the opponent foot is swept lifted up and drawn down on mat (kake) [8]. Muscular strengthening of both upper as well as lower limbs is the basis for good judo players during combat. Muscle Strength depends on the

number of factors like - total number of motor units, muscle cross-section size for example strength of 7 to 10 kg developed from 1 cm^2 cross sectional area of muscle, ratio of fast to slow twitch muscle fibres - fast twitch fibres provide greater strength, energy release from decomposition of creatinine phosphate, fraction of bony levers, age and gender. Two mechanisms explain increase in maximal muscle strength - An increase in muscle fibres and increase in the number of active motor units, In the early training period, muscular strength increases during maximal contractions is mainly due to stimulation of larger number of motor units. Later after two weeks, an increase in strength is attributed to hypertrophy of the muscle [9]. Rapid adaptation of the nervous system explains fast and significant improvement in muscular strength during initial phases of training followed by increasing of strength and muscular hypertrophy in later phases. [10,11] Strengthening of the muscles surrounding a joint boosts structural integrity of the joint and increased muscle mass aids in the frequent falls and repetitive forces from striking and take downs these judokas endure on a regular basis. Development of muscle strength requires the knowledge of physiological mechanisms involved in muscle strength regulation and also importance of number of repetitions performed during exercises.

Flexibility score was 18 for player group and 0.03 for the control in our study suggest that player have adequate session on flexibility training. Good joint flexibility contribute to increased work performance, prevents muscle injury and soreness. In judo quality technique performance in attack, defence and counterattack is important. In throwing techniques of standing position flexibility of the shoulder region is required to interfere with the opponent's balance, and to reach the opponent's legs, which should be hooked, blocked, or swept, for which hip flexibility is most responsible [12]. Flexibility depends on muscle viscosity, ample warm up, distensibility of the joint capsule and compliance tissues like ligaments and tendons that affect the range of motion [13]. A study done on Australian judokas confirmed that Judokas appear to have specific physiological requirements of increased upper body strength and increased flexibility [14].

Agility has been considered to be the ability to execute fast movements and to stop and restart rapidly. Agility score using side step test is significantly higher for player group than controls in our study. Agility skills involve three information processing stages - stimulus perception, response selection, and movement execution which play a crucial part in judo Therefore, their assessment should be considered an integral part of functional testing in elite and invoice judokas. There are some factors which might also affect agility likebody mass, neural transmission delay and technique used in implementing a task which involves agility. [15]. Outstanding sport achievements are rare and require much effort and commitment. Many athletes strive to accomplish them, success is dependable on recent advances in sport training technologies and scientific findings. This study can direct the coaches to devise such training programmes.

Conclusion

Muscle strength, flexibility and agility levels are higher in judo player group than the age matched control group. The findings of the study can help the players and the coaches to understand the effect of training on these parameters and hence can formulate the training techniques for achieving best results from the players.

Support: NIL

Conflict of interest: NIL

Permission: NIL

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