

Impact of Hang Clean Training Intervention on Upper Extremity Muscles Strength Endurance and Lower Extremity Explosive Muscles Power in Judo: A 6 Weeks intervention study on Male Athletes.

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Abstract: The aim of the present study was to investigate effects of 6 weeks hang clean training intervention on upper extremity muscle strength endurance and lower extremity explosive muscles power of judo athletes (n=15) the Age (18-25) of the athletes. The effects of hang clean training intervention on upper extremity muscles strength endurance and lower extremity explosive muscles power were measured through push up test (maximum count in 60 seconds) and standing broad jump tests (Maximum distance covered in CM/Meters). The pre- post - test performance was recorded. The hang clean training intervention session was carried three days a week for 6 weeks schedule. The training load was adjusted, sets, volume, time & repetitions progressively. Mean, Standard deviation (SD) and T- test was applied to determine significance level $p < 0.05$ in the relationship between means of pre-post of hand clean training intervention on upper extremity muscle strength endurance and lower extremity muscles power of judo athletes. The study concluded that 6 weeks hang clean training protocol significantly contributed to the upper extremity muscle strength endurance with regard to Push up test performance and lower extremity of explosive muscles power in the context of standing broad jump test performance for the Judo male athletes.

Keywords: Judo, Hang clean, Standing Broad Jump, Push Ups, Training, Intervention.

Introduction

Judo is a combat and weight-classified sport and athletes participate in different weight categories with the aim of athlete to apply physics, mechanics, agility, explosive upper & lower body power and high technique efficiency to throw the opponent on his back in the completions (15). This sport also requires physiological and mental fitness, along with speed, coordination, strength of judo athlete for optimum performance during training and the competitions. In competitive Judo sport, coaches, sports scientists, and athlete need systematic training plan for the improvement in the training and during competition to obtain optimum performance. Athlete in judo sport learns different techniques or skills Ukemi, Osoto, Ouchi, Kouchi gari, Osaekwmi waza, shime waza and kansetsu waza through the use of Agility, Balance, Power and strength of the body. Participation in competitive judo sport leverage physical fitness components like balance, power and increased mental alertness, coordination and muscles strength to gain advantage over each other (4)

Olympic weightlifting (OW) skills enhance explosiveness, the snatch skill is completed in single movement and clean and jerk skill is executed in to two phases, first clean (Weight lift from the floor and hold on the shoulder) in second part jerk, the athlete push the weight from the shoulder to above the head. OW is the ancestor of modern strength training and fitness, skills such as power snatch, power cleans, hang cleans and squat snatch, and muscle cleans, squats, and deadlifts, are more popular among athletes and sports performance professionals. (13)

The hang clean is a part of OW sport skill Clean and jerk movements. Hang clean movement execution involves Gluteus, hamstrings, Spinal erector, Upper back and spinal erectors of body muscles. (10) The hang clean, word "hang" referring to the starting position because the weight hangs in front of the body versus starting on the floor, it is used as a resistance training in different sports.



The resistance training program is based on sports specific exercises, requirements and proper calculation of variables, volume and intensity and it can be changed according to the objective of sports training. Muscles endurance is the ability to perform many repetitions against resistance for a prolonged period and muscles power is the physical quality to perform quick action dominated by combination of power, strength, speed (3). Specific motor abilities i.e. muscle endurance and explosive muscle power contribute significantly to develop the speed, strength, muscle power and muscle endurance in the athlete for better performance during the training or competitions.

For the better performance in judo the muscles endurance and explosive muscles power are closely related to the athlete's optimum performance at the competitions or training. Muscle endurance and explosive muscles power helps to develop a high-power output (force) in single action of upper body and lower body parts during the competitions or training. A good strength training program gives judo athletes a real edge by improving throws, control during groundwork, and resistance to injuries. Techniques like ne-waza, uchi-mata or seio-nage need explosive power, muscle endurance and ability to generate force fast. Strength training, especially with compound lifts like presses, squats, hang clean and dead lifts builds the upper and lower body strength that demand this move. (Best strength training for jodoco)

For the present study push up test (Maximum count in 60 seconds) was administered to evaluate the muscle endurance of the upper body to assess upper muscles deltoid, pectoral major and triceps muscles endurance of the athletes. The standing Broad Jump Test (Maximum distance cover in jump and measure in cm/Meters) was administered for test of explosive muscles power of lower part of body muscles hamstring, gluts, quads and calves muscles of legs. Both the tests are accepted and used worldwide in different sports and games to assess the muscle endurance and explosive muscles power.

Purpose of the Study

The purpose of the study was to investigate effects of hang clean training intervention on upper extremity muscles strength endurance and lower extremity explosive muscles power of Judo male athletes.

Hypotheses

It was hypothesized that 6 weeks hang clean training intervention have significant contribution to improve upper extremity muscle strength endurance and lower extremity muscles endurance performance.

Methodology

The objective of study was conducted on male judo athletes (n=15), the Age of the athletes (18-25). All the subjects had three years' experience in the judo sport and they are prepared and trained to participate in College, University, and State Competitions in different Judo Academy, training centers or stadiums of New Delhi in India from 2022-2025. After explaining the purpose of the study all judo male athletes and their coaches agreed voluntarily to take part in the study and implement the training intervention.

Training Intervention

The Pre and Post data of upper extremity muscle strength endurance was measured through push up test (Maximum pushup in 60 seconds) and Standing Broad Jump Test (Maximum distance Covered in CM/ Meters) used to measure of lower extremity explosive muscles power. Prior to the test all the subjects were explained the procedure of the tests and allotted 10 minutes for warming up and practice. Hang clean technique was taught by qualified Olympic weightlifting coaches and strength training experts to all the subjects (n=15), after the perfection in hang clean movement the 1 RM test (one repetition with maximum weight) of hang clean test was determined pre and post the training intervention to all the subjects also. The hang clean training intervention was carried out three days a week training load was fixed on the base of volume and intensity. During training session,

the athlete performed hang clean and medium load fixed as $40\% \frac{8}{4}$, $50\% \frac{8}{4}$, $60\% \frac{7}{4}$, $70\% \frac{6}{3}$, $75 - 80\% \frac{6}{3}$ of 1RM was determined. The training load was adjusted progressively by every completed two weeks of training by 15-20%. All the tests for the variables used in study are shown in **table 1**.

Table.1: Variables and Test used for the study

S No	Variables	Test	Score Measure	Remarks
1.	Upper Body Muscle Strength Endurance	Push Up	Maximum count completed in 60 Seconds	2 trails given and best recorded as Personal Score
2.	Lower Body Explosive Muscle Power	Standing Borad Jump	Maximum Distance Covered count in CM/Meters)	3 trails given and best as personal Score
3.	Hang Clean	1RM	One Repetition Maximum in K. g	3 trails given and best recorded

Statistical Analysis

The independent variables Pre-Post 6 Weeks hang clean training intervention were compared the two dependent, variables upper extremity muscles strength endurance and lower extremity explosive muscles. R version 4.1.0 statistical software was used for Mean, SD and T-test to find out the contribution of independent variables hang clean training intervention on upper extremity muscles strength endurance (Push Up test performance) and lower extremity explosive muscles power (standing broad jump test performance) of Judo male athletes. The level of significance was determined at $p < 0.05$.

Result

In the study (n=15) judo male athletes participated as subjects and were busy in 6 weeks hang clean training intervention. The descriptive statistics mean, standard deviation (SD) and T. test were applied to find out mean difference of pre- post training, t-test used to determine significant difference and actual effect of hang clean training intervention on upper extremity muscles strength endurance (Pushup test performance) and lower extremity explosive muscles power (Standing broad jump test) and 1RM progression of hang clean performance also taken before the training intervention as shown in **table 2**. & table 3.

Table. 2: Shows the pre and post of means, standard deviation and T. value scores of effects of hang clean training intervention on upper body muscles endurance and lower body muscle power through standing broad jump and pushups tests.

S. No	Variables	Pre		Post		T. Ratio
		Mean	SD	Mean	SD	
1.	Upper Extremity Muscles Strength Endurance	22.93	1.7	30.93	3.5	2.16

	(Push Ups)					
2.	Lower Extremity Muscle power (Standing Broad Jump)	1.76	0.02	2.12	0.03	2.16

*Significant $p < 0.05$

N=15

Table.3 shows the pre and post Means, Standard Deviation (SD) and T. Value score of hang clean training intervention on the individual performance of 1 RM test of hang clean progression.

S.NO	Variables	Pre		Post		T Ratio
		Mean	SD	Mean	SD	
1.	1RM Hang Clean	46.60	4.56	67.57	6.61	2.15

*Significant $p < 0.05$

N=15

The Effect of 6 weeks hang clean training intervention progression on strength endurance (Push Up Test) and explosive muscles power (Standing Broad Jump) of Judo Male Athletes shown graphically in **figures 1, 2, and 3.**

Figure 1.

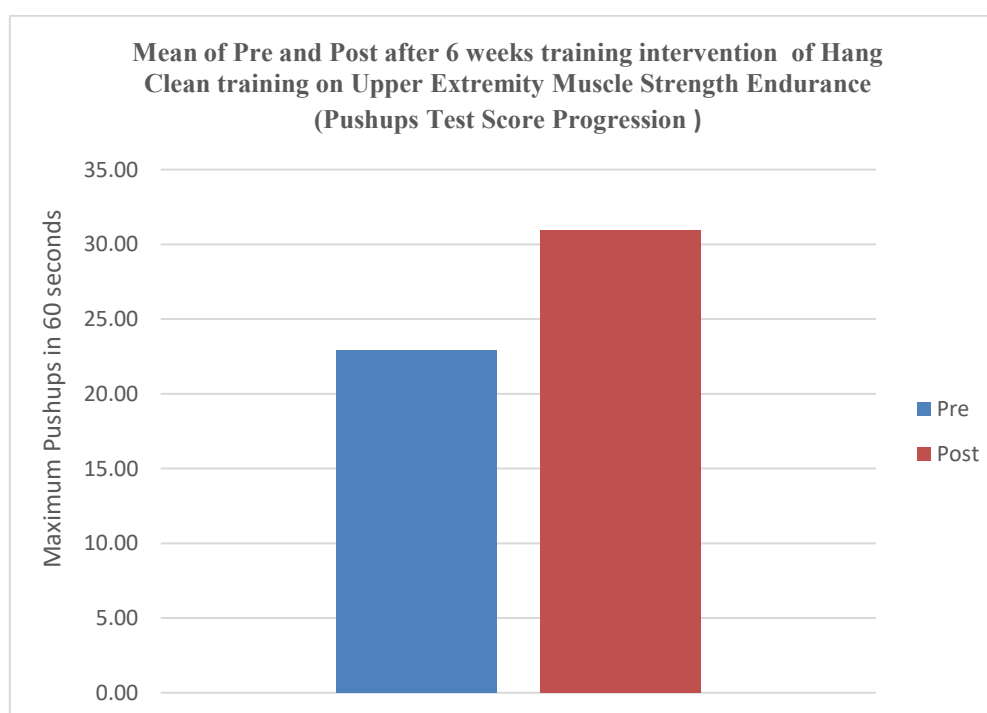


Figure 2.

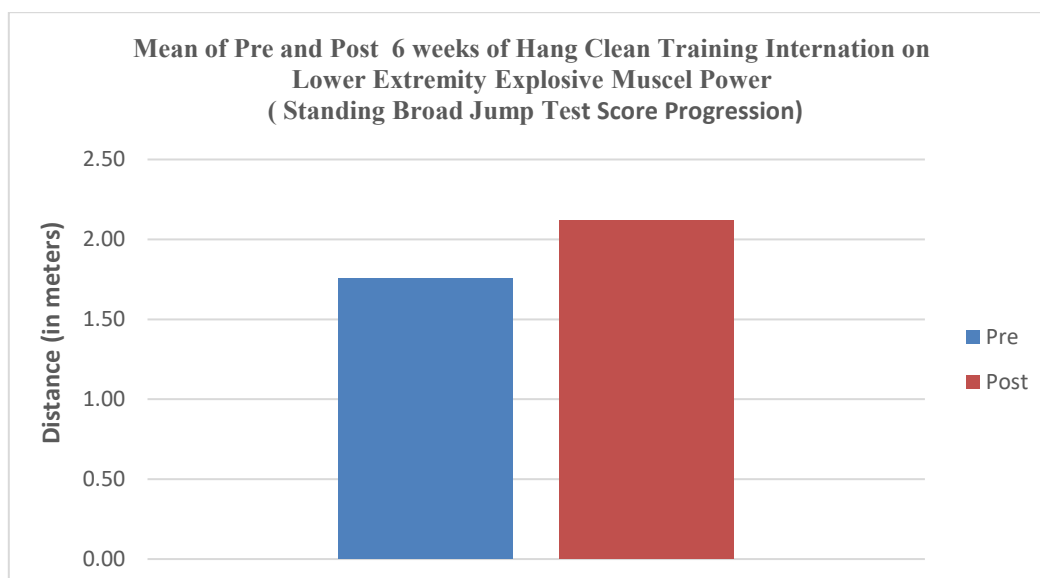
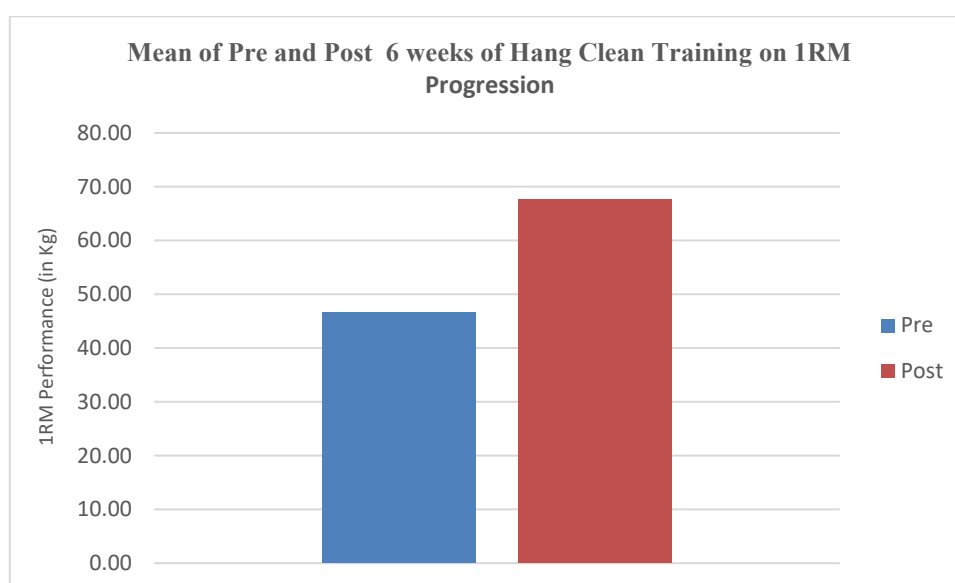


Figure 3.



Discussion of findings

The analysis of data with respect of 6 Weeks Hang Clean training intervention has shown that upper extremity muscles strength endurance (Push up test performance score) and lower extremity explosive muscles power (Standing Broad Jump performance score) found to be significantly related at the Significant 0.05 level. In support of outcome of result, its event also shown the effect of hang clean training protocol on 1RM of Hang clean individual performance of all 15-subject significant improvement in to post training performance result.

Similar views are also given by **Ronai P, et al, (2016)** in their study that hang power clean as a means of resistance training enhancing lower body muscles power and rate of muscle force reaction develop. **Dorla leal (2022)** share his views and supported that the hang clean training is an upper and lower body muscles excises actions are involved. **Zihan Chen (2023)** expressed his opinion that the Olympia Lifting skills and their variations such as power clean, split snatch and hang clean are effective means and methods used as comprehensive training for

other sports. These variations of exercise are designed specifically suggest for certain power and strength dominated sports. **Bompa (2005)** recommended in his book that Olympic weightlifting skills movements snatch, clean & jerk and their assistance exercise hang clean, clean high pull, power snatch and snatch pull are improve upper and lower body strength and power. **Sciberk Roni (2016)** found that the hang clean is a resistance exercise developed the upper and lower extremities muscles groups. **Ronai P, Scibek (2016), & Sullivan Caneiro (2018)**, indicated that significant and positive effect is seen of hang clean on motor components in strength, power, personal skill performance and speed development. Other academic literature support and indicate that power, explosiveness, strength and functional performance related outcome is associated with improved strong gripping (kumikata), throwing (Ura Nage, inner thigh Osoto Gari) tactics and technique in judo sport.

Conclusions

The result of study demonstrates significant positive effects of hang clean training intervention on upper extremity muscle endurance and lower extremity explosive muscle power of judo male athletes. We conclude that the 6 weeks hang training intervention was effective at the 0.05% significance level. Based on result and analyses of previous studies, it implies that the hang clean is a best strength training exercise recombined for Judo athletes builds strong grip, core, upper and lower body muscle power, directly boosting performance during training or competitions throws, holds movements.

Implication of study findings

In the present study several limitations may suggest hang clean training intervention to judo coaches, sports scientists and athletes to consider structured and reproducible approach training program and preparation for themselves to help in optimum performance in the different level of judo competitions.

Conflict of interests

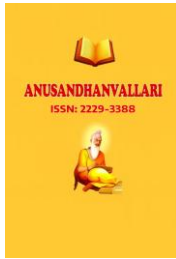
There are no conflicts of interest.

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