

# **EFFECT OF UPPER LIMB EXERCISES ON GRIP STRENGTH IN PIANO PLAYERS**

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## **ABSTRACT**

**BACKGROUND:** Muscle memory is best achieved by asking the muscle to perform with consistent repetition of the intended task. When playing an instrument, smaller distal muscle groups are required to “fine-tune” the sound, while the larger proximal muscle groups produce the basic sound production. Majority of the piano players experience pain in the fingers and wrist. In musicians, the distal upper-limb musculature is overused and proximal upper-limb and trunk muscle groups are neglected. This study aims to find out the effect of upper limb exercises on grip strength in piano players.

**METHODOLOGY:** Experimental study and convenient sampling method. 30 healthy piano players both male and female between the age 18 years to 30 years were selected according to selection criteria. The hand dynamometer was given to analyze their grip strength (the average of the three trails were taken). After that participant was divided into two groups: GROUP A with 15 piano players as the experimental group. GROUP B with 15 piano players as the control group and exercise protocol was followed by the experimental group for 3 weeks. After 3 weeks of exercise, the participants were given hand dynamometer to analyze their hand grip strength as post-test to find the effect of these upper limb exercises.

**KEYWORDS:** Hand grip strength, intrinsic muscles, piano players, VAS, hand dynamometer.

## **INTRODUCTION**

A piano player or a pianist is an individual who plays piano professionally. Based on the way of using their fingers and coordination from the other parts of the body, playing piano can be grouped in two ways. First method is using only the fingers in the piano without the use of support from other body parts such as arms. The second method is using the coordination from the other body parts such arms and trunk. The wrist is dynamic throughout and the weight of the body supports the finger movements (RitSubsomboon. 2017).

**Ajay Malshikare (2017)**, has said that playing a piano requires the correct positioning of fingers, hands, wrist, arm and the whole body. Correct positioning of the wrist and hands and the appropriate movement of the fingers play significant part in effective outcome of the tunes and music. Also the proper positioning of the body in sitting with the hands arched and fingers slightly curved will prevent early fatigue and can enhance the productivity with decreased risk of musculoskeletal injuries. In this study **Ajay Malshikare** has concluded that the musical instrumentalist experienced performance related symptoms in the upper limb which included pain, abnormal sensation in the fingertips, loss of sensation in the fingers and muscle weakness (Ajay Malshikare, et al., 2017).

Musical performance is a complex ability that requires various unnatural static postures and also frequent repetition of the same patterns of movements. (Sforza C. Macri C, Turci M. et al., 2003). In musicians, it has been proposed that imbalances occur where the distal muscles are overused while the proximal and trunk muscles are often neglected. Hence musculoskeletal disorders are very common in these individuals. The risk of repetitive motion injuries and other related musculoskeletal injuries which on further days becomes chronic causing severe pain and disability (Rozmaryn L. 1993)

Studies shows that the requirement on a fixed position for many hours and the repetition of movements affect mainly the upper extremity and cervical region (Bruno S,Lorusso A, Caputo F. et al., 2006, Maria Rosa Ciurana Monino, et al.,2017)

Grip strength is the coordinated activity of the muscles that can be produced in one muscular contraction. Grip strength also provides as an objective measurement for the upper extremity's functional integrity (Myers DB, et al., 1980, Joseph A. Balogun, et al.,1991). To assess the impairment and treatment outcome for the hand functions power grip is a commonly used as an index. Also positioning of the body appears to be a major factor in affecting the functions of the hand as the fine motor control. Also hand could be augmented by the optimal positioning of the upper extremity. Hand grip strength is usually measured by hand held dynamometer that measures the isometric strength of the upper limb muscles thus helps in identifying the muscle weakness (Cledir Araujo Amaral, et al., 2019)

Grip power is the maximum force that an individual can exert under the normal bio-kinetic conditions with forceful flexion of all fingers. (Ackermann B, et al.,2004). The coordinated action of finger flexor and extensor and their interplay plays as an important factor in the grip strength. Also factors such as general muscle strength, upper limb strength, hand dominance, fatigue, age, etc affects the grip strength. This study aims to find out the effect of upper limb exercises on grip strength in piano players.

## **METHODOLOGY**

Prior to the study an approval was obtained from ethical department and then study was initiated. The study design was experimental with pre and posttest type. The inclusion criteria were musicians with piano as major or secondary instrument, both male and females of age group 18 to 30 years were selected, the participant should have an experience of two years and above, any performance related pain reported within 1 year and a score of 3 to 4 in Visual Analogue Scale. And the participants were excluded if the participant was having any neurological disorders, carpal tunnel syndrome, tendonitis, any recent upper limb fracture or any injuries in the upper limb. The 30 participants were selected based on the selection criteria from Octaves school of music, Gudvancherry and divided into group A and group B. With convenient sampling, Group A was considered to be experimental group and Group B was considered to be control group. The procedure was explained and informed consent was obtained. Departmental Ethical clearance also obtained before starting the study. Visual Analogue Scale was used to know the severity of pain. Hand held dynamometer was used to assess grip strength. Three weeks exercise program was followed and each exercise performed three times with an interval and two exercises were added to the second week and repetitions were increased for the third week. These exercises were done one times for three days a week. After 3 weeks of exercise, the participants were given hand dynamometer to analyze their hand grip strength as post-test to find the effect of these upper limb exercises.

In the first week of the exercise protocol for Group A exercises includes squeezing of the therapeutic putty for the intrinsic muscle, resistance web exercise for extensor muscle and resting finger independence exercise were given. In the second week of the protocol in addition to therapeutic putty, resistance web and resting finger independent exercises, alternate leg and arm fall , cervical rotation were added .In the third week of protocol the exercises include therapeutic putty for intrinsic muscle, resistance web for extensor muscle, resting finger independence exercise, scapular retraction and depression, alternating leg and arm fall out, cervical rotation with progression were done.

For Group B, advices for postural correction were taught like neutral position of head and neck, curving their fingers, aliening the shoulder and hip for balance and using a foot stool to rest the feet.

## **RESULTS AND DISCUSSION**

The collected data were analyzed and tabulated. Standard deviation and mean were used to assess all the parameter of the data using a paired sample test. The results were tabulated and plotted accordingly. IBM SPSS Statistics version 20 Software was used for data analyzing.

**Table I** shows the result of pre-test and post-test values of the experimental group, where the mean value of pre-test is appeared to be 29.53 and the mean value of post-test is appeared as 38.73 with a p-value of 0.00 which is significant at ( $p < 0.05$ ). **Table II** shows the result of pre-test and post-test values of the control group where the mean value of pre-test is recorded as 31.47 and the mean value of post-test is notes as 34.47 with a p-value of 0.00 which is significant at ( $p < 0.05$ ).

**Table III and BARDIAGRAM I** shows the result of post-test value of the experimental group and control group, where the mean value of the experimental group is recorded as 38.73 and the mean value of control group is appeared to be 34.37.

The results showed that experimental group has a better result than the control group. There was improvement in the post-test of both the groups, but by comparing the mean values improvement was seen in the post-test of experimental group which depicts that the given protocol is effective in improving the grip strength in piano players.

This study aims to improve the strength of hand grip using an exercise protocol which concentrates on improving the strength of wrist and the whole upper limb which is the vital part of a piano player as it will help them play efficiently. The musculoskeletal problems affecting these regions will reduce their efficiency and will eventually reduce the hand grip strength; this may be also caused due to any stress or overpressure in various parts. The posture of hand and the body also play a major role in injury and in reducing the hand grip strength (George F. Hamilton, et al., 1992)

The exercise protocol for experimental group concentrated on localized correction such as wrist exercises, finger mobilization, and exercises for static stability, which mainly showed improvement in the wrist and finger position while playing thereby improving the handgrip. The intervention given to the experimental group included scapular retraction and depression, cervical rotation with resistance which reduces serious back problems during long term playing and good posture and balance of the body, squeezing the resistance web with fingers will train all the small intrinsic and extrinsic muscles of the hand and helps in increasing the grip strength.

The intervention given for control group was postural correction as improper posture requires higher muscle activation for support and increased static loading. So, proper posture allows the supportive muscles to sustain the static and dynamic movements and joints will be more stable during the performance. The exercise protocol given for group B were correcting the postures like neutral position of head and neck, curving their fingers, aliening shoulder and hip for balance and using a foot stool for resting feet (Kaufman-Cohen Y, et al., 2011)

Also, **Cliffon Chan et.al**, has concluded that there was a significant reduction of playing-related musculoskeletal disorders that concentrates on the lower back, shoulder and mainly teaches different comfortable positions for the musicians (Chan C, et.al., 2014)

**Ajay Malshikare, et.al 2017.**, suggested that the handgrip strength was measured for different musicians and was found that their hand grip has an important part relating to there playing which many of them were not aware and the participants were given flexor stretching before and after playing. The grip strength of hand was found to be higher in the head-neck neutral position which was followed by rotation to the right in the participants (Zafar H, Omar MT, et al., 2018). **Lili Allsopet al.**, found that excessive workloads with the complexity of compositions and intensity of repertoire might be linked to the incidence of playing-related musculoskeletal disorders and a significantly higher rate was observed when players engaged with more than 5-40 hours of practice (Allsop L, et al., 2010). **Katherine Butler, et al.**, has also stated that therapeutic putty exercises can be very helpful in improving proprioceptive awareness and intrinsic muscle strength ( Katherine Butler, et al., 2011)

This study mainly concentrated on improving the handgrip strength and the posture of the piano players by giving them intervention improving their upper limb, wrist, fingers and their trunk which will help them in playing more accurately and will give them increased grip strength which will help them strengthen their finger flexors and extensor that will help in increased speed in notating different notes according to their music chart.

## CONCLUSION

This study concluded that there was significant effects of upper limb and postural exercise on hand grip strength in piano players.

**TABLE I PRE AND POST-TEST VALUES OF HAND GRIP STRENGTH OF GROUP A**

		MEAN	SD	t VALUE	SIGNIFICANCE
<b>GROUP A</b>	<b>PRE-TEST</b>	29.53	8.5	-8.11	.00
	<b>POST-TEST</b>	38.73	7.5		

**TABLE II PRE AND POST TEST VALUES OF HAND GRIP STRENGTH OF GROUP B**

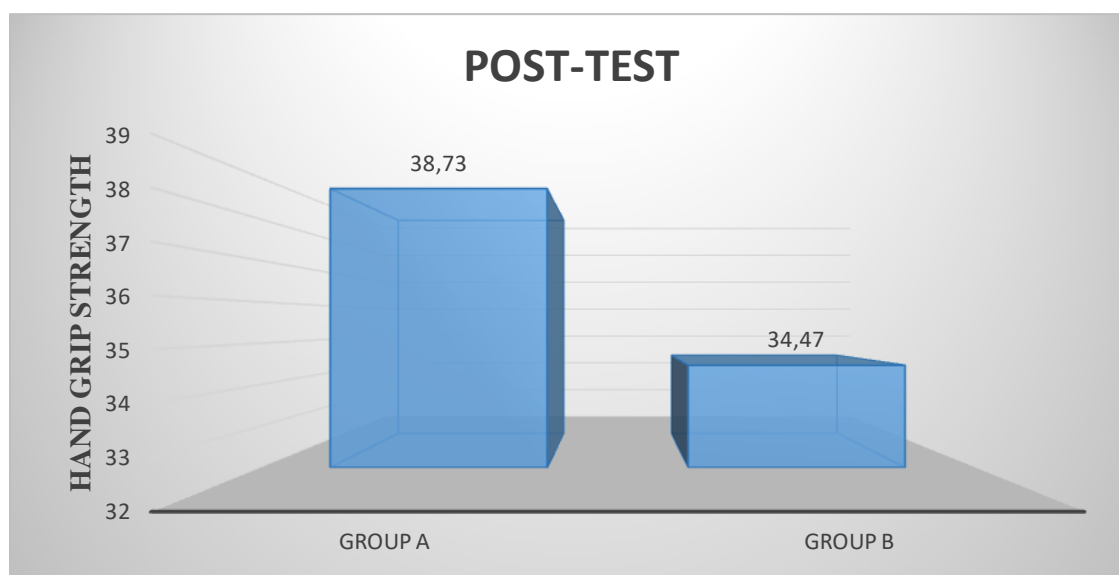
		MEAN	SD	t VALUE	SIGNIFICANCE
<b>GROUP B</b>	<b>PRE-TEST</b>	31.47	6.9	-8.22	.00
	<b>POST-TEST</b>	34.47	6.5		

**TABLE III COMPARISON OF POST-TESTS OF HAND GRIP STRENGTH OF GROUP A AND GROUP B**

		MEAN	SD	t VALUE	SIGNIFICANCE
<b>POST-TEST</b>	<b>GROUP A</b>	38.73	7.5	20.1	.00
	<b>GROUP B</b>	34.47	6.5	20.3	.00

**BAR DIAGRAM I**

**COMPARISON OF POST-TEST VALUES OF HAND GRIP STRENGTH OF GROUP A AND GROUP B**



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