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RESEARCH ARTICLE
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IMPACT OF A STRUCTURED PUNCHING BAG EXERCISES ON PROMOTING HAND AND ARM MUSCLE STRENGTHENING

Hafiz Muhammad Waqas Munir[1], Nasir Mehmood[2*], Afifa Latif[2], Mahtab Ahmad Mukhtar Patafi[3], Prem Lata[4], Noman Ahmed[5], Nairish Karim[6], Rida Tanveer[7], Rehmana Rashid[8], Madiha Akram[9]

[1]DHQ Hospital, Khanewal - Pakistan
[2*]Department of Physical Therapy, Faculty of Medicine and Allied Health Sciences, The Islamia University of Bahawalpur - Pakistan
[3]Pervaiz Ilahi Institute of Cardiology, Bahawalpur - Pakistan
[4]Bahria University of Health Sciences, Karachi - Pakistan
[5]Isra University, Karachi Campus - Pakistan
[6]Institute of Sonology, Karachi Pakistan
[7]University College of Conventional Medicine, Faculty of Medicine and Allied Health Sciences, The Islamia University of Bahawalpur – Pakistan
[8]Department of Pharmacy, The Women University Multan, Pakistan
[9]School of Medical Lab Technology, Minhaj University Lahore, Pakistan

***Corresponding Author:** Nasir Mehmood
*Department of Physical Therapy, Faculty of Medicine and Allied Health Sciences, The Islamia University of Bahawalpur - Pakistan Email: n.mehmood777@gmail.com

Abstract
This experimental study assessed the effects of punching bag exercise on hand grip strength. Thirty students were randomly selected to participate in the six-week intervention entailing punching bag exercises three days per week. Hand grip strength was measured using a dynamometer before and after the program and data was analyzed with SPSS version 23.0. Outcomes highlighted significant improvements in grip strength. Pre-intervention results indicated 16 participants had poor and 14 had moderate grip, while post-testing evidenced enhanced strength with only 2 poor, 18 moderate and 10 demonstrating high grip scores. Comparison of pre and post data revealed the punching bag regimen significantly increased strength with $p<0.05$. Through repeatedly striking the bag, muscles involved in hand grip are activated leading to marked improvements. Overall, this study underscores that structured punching bag routines conducted over six weeks can build hand and arm muscle strength as quantified through grip metrics. The repetitive motion nature of hitting the bag promotes positive adaptations in these muscle groups resulting in participants advancing across poor and moderate baseline grip levels to elevated strength.

Introduction
Muscular strength is a component of health-related physical fitness and it has the ability to perform activities which need muscular force. Hand grip is one of the common tests to assess muscular strength. (1) Muscles hypertrophy, range of motion, gender, type of muscles fiber, muscles coordination and muscle shortening velocity are the internal factors which effects muscular strength. Despite internal factors, some external factors like motivation, type of training, time of day and

anabolic steroids are also affects muscular strength. (2) Hand grip strength is considered as a predictor of several diseases. Heart disease, cerebrovascular disease, cognitive disorders and risk of fractures were also predicted through hand, grip strength. Several studies correlated hand grip with nutritional status, bone mineral content, hand length, body mass index, age and upper arm circumference. (3) Hand grip strength declines after midlife and continuously declines with ageing. (4) Hand grip strength test is a common way to measure several muscles strength in arm and hand. It is a physiological variable. Research supported a significant positive association of dominant and non-dominant hand's strength with weight, height and body surface area. (5) It is usually measured by a dynamometer. It gives reliable and useful information about overall health. (6) Hand grip strength test is a simple and economical method to assess hand grip strength as well as grip control strength. Test also provides practical information about muscles, bone, nerve and joint disorders. (7) Hand grip assessment helps to evaluate the patient's initial limitation and also helps to evaluate the progress during the rehabilitation phase and also provides the effectiveness of the treatment. (4) Low hand grip is a predictor of poor clinical results furthermore low hand grip with ageing predicts functional limitation, disability, and other health related complications. Poor hand grip is also a predictor of cardiovascular diseases. (8) Patients with Low hand grip strength are unable to perform their daily life activities which involve the upper limbs. Decrease quality of life is also associated with improper hand grip strength. (1) Hand weakness caused by the occurrence of injuries, the occurrence of problems in ligament, occurrence of bone and joint problems. Reduced blood supply and skin-related issues at hand muscles may be created. Blood sugar or Blood pressure also cause in the weakness in hands. Extreme occurrence of fatigue and fever or other systemic conditions may cause weakness in hands. (9) Generally, hand grip strength is executed with the dominant hand to identify the maximum strength value. Studies evident 10% higher hand grip strength of the dominant hand as compared to non-dominant hand. (10) Hand length, hand shape, and body height ratio determine grasping capability while palmar length and width ratio and other anthropometric parameters determine grip strength. (11) Effect of hand measurements like finger span, finger lengths, perimeters of the hand and hand shape were also studied in different populations. (12) Hand grip strength is also used to evaluate an individual's work capacity, physical capacity, degree of injury or disease processes and progress in the rehabilitation stage. In shorthand grip strength and pinch grip strength informed the functional integrity of the upper limb. A better outcome of hand grip strength is related to the nutritional status of the individual and also decreases the risk factors of disability, functional limitation or impairment and various chronic diseases. (13) Hitting on the bag builds stamina and punching power and can increase your metabolic rate for days afterwards. Your legs and arms are involved in activating, and training the whole-body muscle as possible and it helps to burn the most calories. (14) Boxing exercise promotes comprehensive physical training. Furthermore, boxing moves require all movement capacities of arms especially all properties of the locomotors system. It is further added that boxing is one of the most effective physical trainings for the bodies of those who go in for it. Physical exercises are used as physical training means. (15-16)

Methodology

An experimental study was designed to find the effects of punching bag exercise on the hand grip. In the age range of 18 years old to 26 years old, 30 undergraduate students were selected randomly from different institutes and universities. Four-week punching bag exercise was done on alternating days. The hand grip strength of the dominant (right or left) hand was measured using a standard hand grip dynamometer at a standing position with the shoulder adducted and neutrally rotated, with an elbow in full extension before and after the punching bag exercise. Participants were asked to put maximum force on the dynamometer. The maximum value was recorded in kilograms. Three readings were taken with 30 seconds intervals on alternative days a week for six weeks. Data were evaluated by using SPSS-21 software. Descriptive statistics were used to analyze the frequency and a chi-square test was applied.

Results

The mean age of participants was 20.77 ± 2.753 years old. Figure 1 shows gender ratio of participants, out of 30 participants 14 (46.67%) were male and 16 (53.33%) were female. (Shown in Table IV-2 and Figure IV-1.

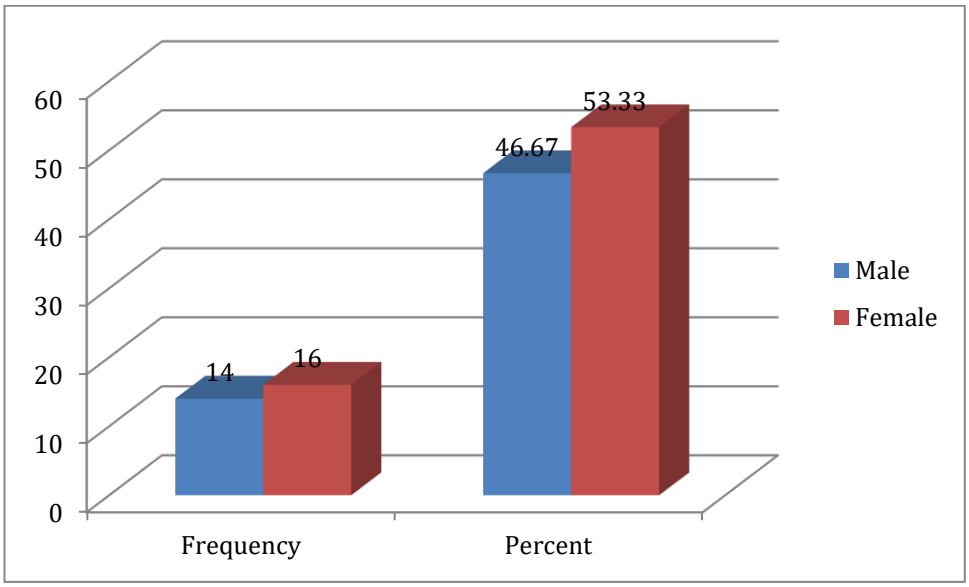

Figure 1. Gender of the participants

Figure 2. shows the results of hand grip strength, out of 30 participants Pre-Punching Bag exercise, 16 had poor hand grip, 14 had moderate hand grip while Post Punching Bag exercise results showed, 2 had poor hand grip, 18 had moderate hand grip and 10 had high hand grip strength. The comparison of pre and post-value of hand grip strength found <0.05, which showed significantly effective.

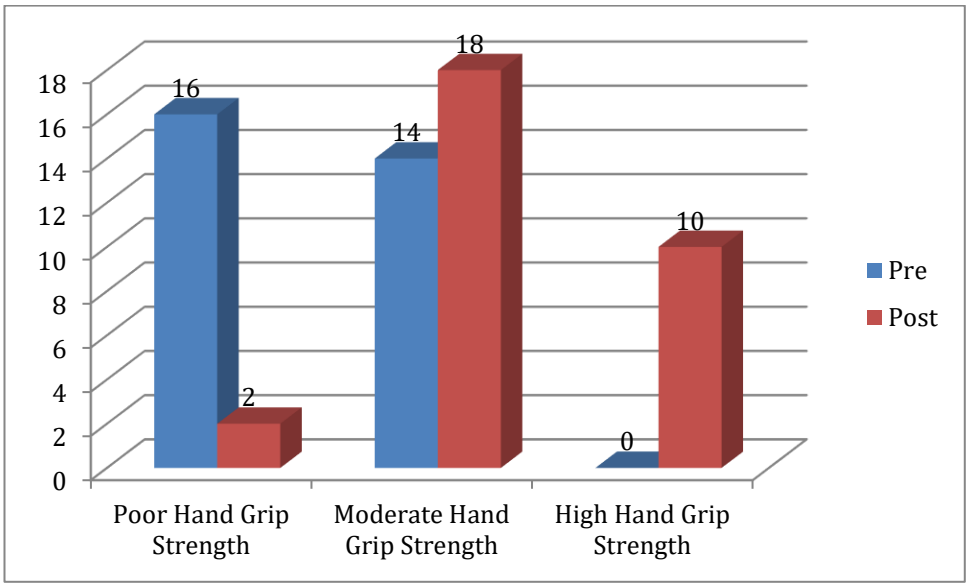

Figure 2. Pre and Post Scores of hand grip strength

Discussion

A study conducted to find the effects of training of boxing on physical and cognitive function in Parkinson's Effects Of Boxing Training On Cognitive And Physical Function in Parkinson's Disease Patients. The score increased by (24.2 ± 3.8) pre to (25.7 ± 4.4) post in a session, *with p-value 0*.01. Improvement was found in physical and cognitive function in a single session of training of boxing training in patients. (17) Wan Firdaus et al., conducted a study on males to find the effects of complex

training on the strength of muscles among weightlifters. Overall results showed significance in pre and post results in knee extension peak torque p value 0.003, and in knee flexion peak torque p value 0.001. There were improvements found between the control groups and the complex training group. (18) Boxing exercises give a positive effect on physiological variable and biochemical variables. This impact can be shown by participating regularly of the boxing training program. (19) Injury at the hand or wrist region had been the biggest reason of absence at work. The associated factors found were a repetition of awkward movement, intensive motions, & occupation-related factors. All were found to be associated with WMSDs of hand/wrist. The pathophysiology may involve injury of soft tissue leading to inflation. This was followed by the repair stage & scarring. All this may involve the soft tissue & neural tissue in the region. Health professionals when dealing with such cases should keep these things in mind while examining & planning treatment for such as these factors can directly influence the outcomes of the treatment plans. (20) Submaximal handgrip endurance training at 30% of MVIC had a minimal effect on submaximal isometric handgrip endurance and maximal voluntary isometric contraction of the handgrip, but it had a large effect on RHW of the trained extremity. (21) Strengthening exercises for individuals with rheumatoid arthritis hand deformity are beneficial to improve handgrip and pinch strengths as well as functionality. (22) Wakpaijan et al., conducted a study to find the effects of different two resisting exercises on strength of grip. The study concluded that 4 weeks for 4 days per week of individual exercises were effective but on comparison between the two groups, there was no significant difference in hand grip strength. Conclusion: Both exercises were equally effective in improving hand grip strength. (23) Another study evaluated the effect of resisted exercises and free weight exercises on the improvement of grip strength of cricket players. The study concludes that hand grippers and therapy can also be used for the improvement of grip strength of cricket players. (24) Patrick et al., conducted a study to find the outcome of Fat Grip Training on Driving Performance and Muscular Strength. The FG group participants finished repetition and every lift using FG, associated with the group doing CON training used normal diameter bars. The FG group found significant in the speed of ball speed, carry, left hand grip and drive distance strength later eight weeks of RT. (25) M Soysal Tomruk et al., defined that Core stability exercises were more effective than home exercises to improve manual dexterity and grip strength in patients with chronic neck pain. Core stability training should be added to rehabilitation approaches in order to enhance upper extremity functions. (26) Fabrício Edler Macagnan et al., conducted a study to find the acute effect of photobiomodulation therapy on handgrip strength of chronic kidney disease patients during hemodialysis. the maximal handgrip strength was evaluated before and after PBMT/placebo treatment in each session. Significant strength increases occurred after PBMT application with doses of 60 J/arm (4.85%, $p = 0.005$, $ES = 0.32$) and 90 J/arm (4.45%, $p = 0.013$, $ES = 0.25$). 60 J/arm was the best dose/response for increased strength of the small muscles (handgrip strength). (27) A study designed to evaluate the relationship between handgrip strength and personality factors among adults. Results showed that handgrip strength was negatively associated with neuroticism in men and agreeableness in females while positively correlated with extraversion in men. Furthermore, an association between handgrip strength and neuroticism in males continued after controlling for the influence of age and body mass index. Researchers concluded that handgrip strength delivers information about male neuroticism. (28) Another study found a significant association between malnutrition risk and muscle weakness and overall results suggested that measurements of handgrip strength of the dominant hand are more accurate when assessing nutritional status. The researcher concluded that there were no significant associations between malnutrition diagnosis and handgrip strength who were assessed by PG-SGA. (29) According to Martins JC et al., There is a significant correlation between scores of worldwide strengths of the paretic upper limb and strength of grip and between upper limb motor function and handgrip measured by MST and handgrip dynamometer in stroke patients. Only worldwide strength keeps on as a significant predictor variable of the strength of grip for the MST and handgrip dynamometer in stroke patients. (30) Handgrip strength is correlated with self-perceived happiness, health, social confidence, and number of sexual partners. Handgrip strength is also associated with self-assessed physical fitness, and it is an indicator of genetic quality and developmental health. (31) A study investigates the handgrip strength relative

to gender and type of deformity among orthopedically challenged individuals affected with upper limbs with normal individuals a study was conducted. Results revealed that the hand grip strength of orthopedically challenged subjects was comparatively lower than normal individuals in both hands. Female subjects had lesser handgrip strength than male subjects. Furthermore, grip strength of different categories of orthopedically challenged persons had significant variations only in the case of left hand female subjects. (32) Koley S et al., assessed the anthropometric measurement and examined the correlation between anthropometric characteristics with handgrip strength among computer users and non-computer users. Results revealed significant differences among both groups except hip circumference. In the computer user group significant correlation was found in handgrip strength and anthropometric measurements. The researcher concluded that even with higher BMI Indian computer students had lower handgrip and back strength than the control group. (5) In the relationship between muscular strength and work enactment among mentally retarded students. All isometric strength measurements indicated a significant difference between groups and the strength program was effective in increasing physical functioning and work-related skills among school students with mental retardation. (33) (41) A study was conducted to examine the most correct technique and sources of conclusion values for the valuation of strength with the MST. Afterwards, measuring all muscular groups, comparable values were established for all sources of outcome in results that were found positive and significant. The study concluded that all MST techniques showed satisfactory results for evaluating the strength in healthy persons. (34) Dominant and non-dominant hand grip is positively associated with height, weight, hand span, wrist circumstance and hand length with hand grip while body mass index and hand breadth have no significant association with hand grip in healthy Indian females. (35) Study was conducted to determine the relationship between anthropometric measurement and strength of hand grip related to dominant and non-dominant hands. Results revealed a weak positive association between the hand grip strength of the dominant hand with height, weight, and body mass index among Brazilian men. The study concluded that anthropometric variables may be less relevant than physiological variables. (2) A cross-sectional study was designed to identify the relationship of anthropometric measurement and hand span with hand grip strength in adults. The finding showed that the hand grip strength of the dominant hand is positive with height, weight, BMI and hand span. Results found a weak positive relationship between the grip strength of the dominant hand and waist circumference and waist-hip ratio. (36) Right preferred boys and girls scored a stronger association with hand grip strength while left-preferred girls had a strong relationship, but results found no relationship in left preferred boys in favor of both hands. (37)

Conclusion

This study concluded that punching bag exercise is effective for increasing the strength of hand grip. There was a significant result found in the comparison of pre and post results. In the punching bag exercise participant hit punch on the bag and this repetitive act increases the strength of the muscles involved in grips of the hand.

Recommendation

This study recommended that punching bag exercises had significant effects on muscle strength so it will be implemented in school and college populations during sports activities, it also recommended for future research conducted on different age groups and long-term effects of punching bag exercises on muscle strength and cardiovascular function and those people will be selected who have active lifestyle and low fatigue level.

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