

Effect of Sport Specific Strength and Conditioning Training on Strength and Power among Mixed Martial Arts Athletes

Ilakia S¹, Muthukumaran Jothilingam², Praveen Vasanthan Murugan³

¹Postgraduate, ²Professor, ³Postgraduate, Saveetha College of Physiotherapy, Saveetha Institute of Medical and Technical Sciences, Chennai, Tamil Nadu, India.

How to cite this article: Ilakia S, Muthukumaran Jothilingam, Praveen Vasanthan Murugan. Effect of Sport Specific Strength and Conditioning Training on Strength and Power among Mixed Martial Arts Athletes. Indian Journal of Physiotherapy and Occupational Therapy / Volume 18, Year 2024.

Abstract

Background: MMA is an intermittent sport with short, intense phases of activity repeated for 3-5 rounds of 5 minutes each, separated by 1-minute breaks. This complexity demands diverse physical skills (power, strength, speed, endurance) and metabolic processes (anaerobic, aerobic) in practice and competition.

Purpose: To determine the impact of a sports-specific strength and conditioning (S&C) training regimen on MMA competitors' performance.

Materials and Methods: A total of 30 MMA athletes were selected. 1RM strength test, medicine ball throw and vertical jump test were used as outcome measures. 30 players were divided into two groups. Sports Specific S&C protocol (S&C group) and general strength training (conventional group) for a period of 8 weeks.

Results: Post mean and standard deviation of 1RM (bench press, squat), Medicine Ball throw and vertical jump test of S&C and conventional group were 108.3 ± 3.68 , 99.93 ± 5.22 , 11.80 ± 0.41 , 46.27 ± 2.22 and 99.87 ± 2.77 , 93.0 ± 4.71 , 10.1 ± 0.78 , 42.87 ± 3.34 respectively. The S&C group were more significant than the conventional group with p value < 0.001.

Conclusion: It has been concluded that the sports-specific S&C training had a positive impact on performance among MMA athletes.

Key Word: High intensity training, performance, MMA athletes, competitive training.

Introduction

MMA has gained a great deal of attention recently, which has sparked a lot of interest in physical fitness assessment and training for this athletic discipline. Due to the challenge of enhancing both offensive and defensive tactical skills, as well as speed, strength, and endurance, the periodization of the MMA training technique is unique¹. MMA may be considered a sport that is intermittent with minute-long breaks

in between each round and bursts of high speed and power effort occurring every 3 to 5 minutes. Consequently, MMA is an extremely physically demanding sport that requires a wide range of physical skills (such as speed, power, strength and muscular endurance) as well as metabolic processes (both anaerobic and aerobic) during training and competition. In addition to having high levels of power, speed, strength, aerobic fitness, and anaerobic

Corresponding Author: Ilakia S, Post graduate, Saveetha College of Physiotherapy, Saveetha Institute of Medical and Technical Sciences, Chennai, Tamil Nadu, India.

E-mail: ilakiasundar1920@gmail.com

power, MMA competitors must use and combine multiple different fighting styles in order to survive the 3-5 rounds. Due to their extreme physical and technical requirements, these athletes require unique strength and conditioning training regimens^{2,3}.

Combinations of high-intensity, swift-moving activities, such as striking and grappling, have been used to define MMA. These motions demonstrated how the upper and lower extremities needed to have strong dynamic and isometric muscles as well as substantial amounts of endurance in both aerobic and muscular activities^{4,5}. MMA has a variety of physical requirements that must be met in order to be successful. Upper and lower extremities power and strength are combined during hitting and wrestling in a variety of movement planes and along both open & closed kinetic chains. For resisting an opponent over short distances (1-2 m), agility is essential, as is moving closer to them and preparing an attack. Good footwork and the ability to strike effectively depend on limb speed. Due to the requirement to maintain a physique category that is appropriate for their size, relative strength, and functional skills, hypertrophy is less important than the ability to operate against a competitor's mass⁶. For effective hitting and a capacity to influence a competitor's posture, power is a crucial quality. Force transfer through the transverse plane is necessary for impact⁷.

Power can also be thought of as the speed at which work is performed. In athletics, the term "power" refers to the combination of force and speed. Maximum power, commonly referred to as peak power, is the amount of work a muscle can accomplish in a specific length of time⁸. High force rates result in very low velocity, while low force levels result in high velocity. It has been shown that a variety of loads may be used by an athlete to train with in order to increase their muscle power in a variety of activities.

This is because everything below the curve represents the amount of power that is available for a given force and velocity. These loads range from 10 to 70% of the most that can be lifted in a single repetition. In other words, it is possible to measure the peak power in multi-joint movements using a wide variety of different percentages. These loads determine the amount of force and speed needed

to complete a movement, which yields a particular amount of power. A well-established S&C programme for MMA participants seeks to increase each athlete's force velocity curve by enhancing speed and force.

Strength is yet another crucial element of MMA training regimens. Strength is the ability of a muscle or set of muscles to generate muscular force under specific conditions. It is the outcome of electrical activities in the body's neurological system controlling and initiating muscular activity. According to biology, strength is mostly a result of a suitable muscle being effectively stimulated by the nervous system to contract vigorously. As a reaction to neuromuscular stimulation, the nervous system has two main adaptive and interconnected effects on the body. Hypertrophy and functional muscle activity are these outcomes. Strengthening is a second, equally important goal of the MMA S&C programme so that the athlete can use more force and, ultimately, more power when performing techniques⁹.

Effective MMA athletes must obviously have a broad skill and knowledge base in a range of martial arts techniques. An effective S&C programme to improve overall fitness is essential for these athletes to maintain their high levels of performance. The key benefits of the S&C programme are injury prevention and performance enhancement¹⁰.

The intention of this study was to evaluate the effect of a regular, 8-week programme based on circuit training involving strength as well as power training with specific to a sport power and strength exercises, i.e., exercises that are biomechanically like movements performed during MMA, such as medicinal ball throws simulating a punch. Despite its lower volume and perceived effort, it was predicted that the later regimen would produce superior gains in performance parameters important for MMA.

AIM

To determine the effect of sport-specific S&C training regimen on performance in MMA athletes.

Materials and Method

In the experimental study, a total of 30 young athletes were chosen from Saveetha School of Physical Education, Chennai. The subjects were between the

age groups of 18 and 25, comprising 12 female players and 18 male players. The subjects were selected using a random sampling method.

The study was conducted from September to December 2022 at Saveetha School of Physical Education, Chennai.

Inclusion criteria

- MMA athletes between the age groups of 18 and 25 years old.
- Both male and female MMA athletes were included in the study.
- MMA athletes who have been actively participating in the sport for a minimum of 2 years.
- Athletes who were available and willing to participate in the study during the designated period.

Exclusion criteria

- MMA athletes who have recently suffered an injury that may impact their physical performance or ability to engage in the study.
- Athletes with a history of surgical procedures on their spine or extremities that may affect their physical capabilities.
- Athletes who are currently in the off-season, as their training and performance levels may differ from those in the competitive season.

Outcome measures

- 1 RM Strength Test (bench press and squat)
- Medicine ball throw
- Vertical jump test

Each test had a scheduled warm-up and cool-down period, and that was conducted under the supervision of the qualified professional. All tests were performed according to standard protocols; the participants were allocated with three trials, with the average of all three being used as one data item.

Procedure

The objectives of the study were explained to everyone, and written informed consent was obtained. Selected participants were randomly allocated into conventional and S&C groups using an opaque enclosed envelope; pre-test values for

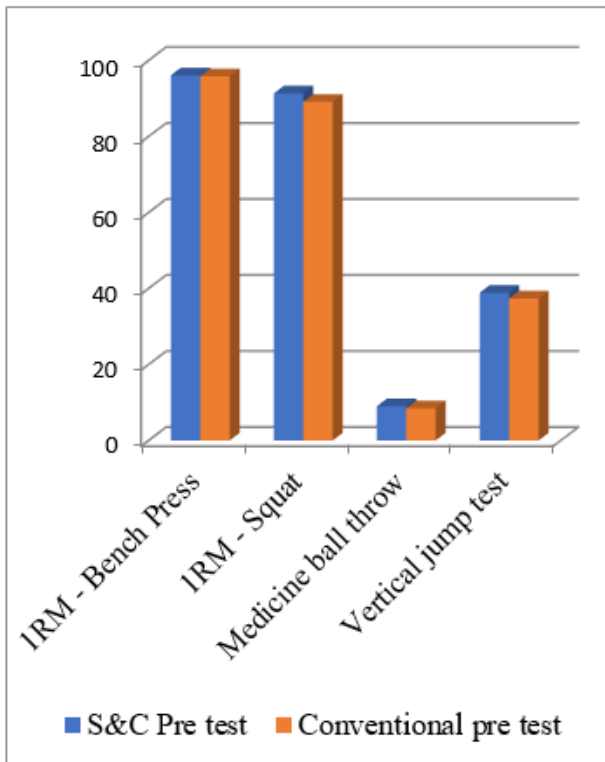
strength and power were assessed. Upper body Strength of the athletes was measured by bench press and lower body by squat using 2.5% rule; upper body power of the athletes was measured by medicine ball throw and for the lower body by vertical jump test. Participants in the S&C group were trained for high intensity sports specific S&C training for 8 weeks' time duration; conventional group participants were asked to continue with their regular training, and they were asked to maintain an exercise diary for 8 weeks. At the end of 8th week, post-test values were assessed the same as pre-test. All the data were collected.

This eight-week S&C program is designed specifically for MMA athletes who train four days a week on alternate days, with two days dedicated to strength training and two days for power training. Additionally, there are two days dedicated to regular MMA practice, with one day of rest. S&C training starts with 10 minutes warm-up before each session and cool-down afterwards to prevent injuries. Weights and intensity were adjusted based on fitness level.

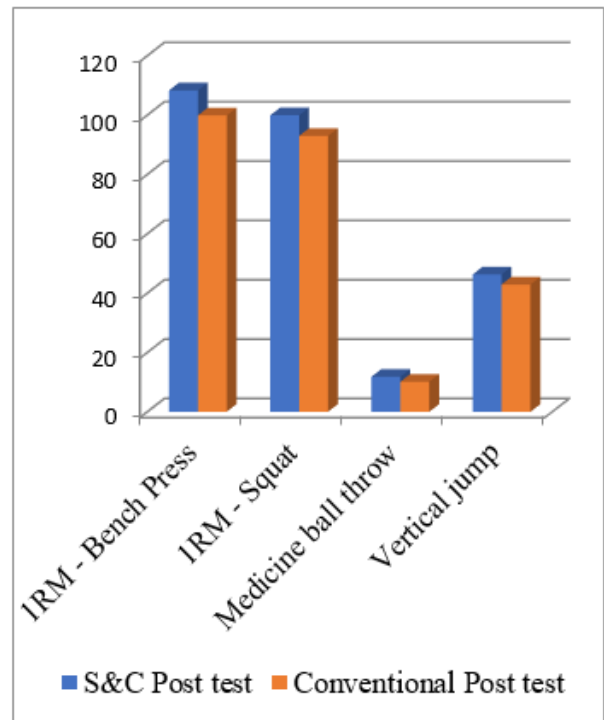
Sports specific S&C exercises for MMA athletes should focus on developing key physical attributes required for the sport, including strength and power. Strength training exercise like push ups with weight, Bench press, Barbell rowing, Overhead press, Deadlift, pull ups, Cable face pull, one arm dumbbell row, Squat, Lunges with weight, Pause SSB squat, Stiff leg deadlift, Bulgarian lunges. Power training exercise like Kettlebell swing, Clean & press, Sumo deadlift high pull, countermovement jump, med ball throw, farmers walk, Lunge jumps, Split squats, Med ball rotational throw, lateral jump, overhead med throw, suitcase farm walk.

Data Analysis

The descriptive statistics, such as mean and standard deviation (SD), were used to analyse the data. The Wilcoxon sign rank test was employed to examine the significant differences between the groups, while the Mann-Whitney U test was used to analyse within-group differences.



Graph 1 shows the pretest values of S&C and conventional group between the groups



Graph 3 shows the pre and post -test values of S&C group within the group

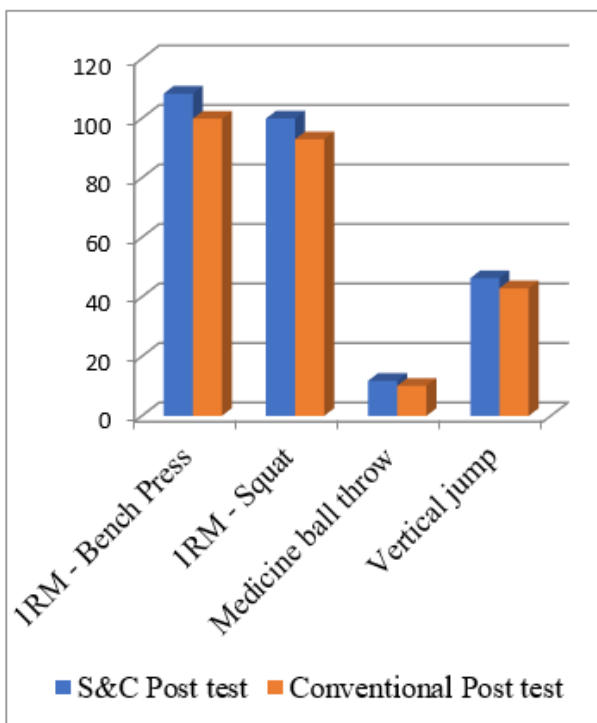
Results

All 30 subjects successfully completed the study, the mean age of the participant 22.3 with standard deviation of 2.3 years. At the end of 8th week all the athletes were evaluated, and their data were calculated. The pre-test and post-test mean and SD values for 1 RM squat were 91.33 ± 6.04 and 99.93 ± 5.22 , respectively. Similarly, the pre-test and post-test mean and SD values for 1 RM bench press were 96.07 ± 3.03 and 108.3 ± 3.68 . For the medicine ball throw test, the pre-test and post-test mean and SD values were 9.0 ± 0.85 and 11.80 ± 0.41 . Lastly, the pre-test and post-test mean and SD values for the vertical jump test were 38.87 ± 2.17 and 46.27 ± 2.22 .

All these improvements were found to be statistically significant with a p-value of less than 0.001.

Discussion

The main outcome of the present study highlights the effectiveness of a sport-specific S&C training programme in significantly improving the physical fitness of MMA athletes. This specialized training



Graph 2 shows the post -test values of S&C and conventional group between the groups

approach demonstrated superior results compared to a regular circuit training programme. This finding underscores the importance of tailoring training programmes to the specific demands of MMA and the potential benefits of incorporating strength training in enhancing power and overall performance.

Clay Harden Walker et al. found that different variables contributed significantly to the increase in peak power for each MMA technique. Specifically, the deadlift and a combination of deadlift and bench press for strength were identified as responsible for substantial gains in peak power for the cross and knee techniques. This supports the notion that augmented strength variables play a vital role in enhancing peak power in specific techniques¹¹.

Lukasz Tota et al. conducted a study where they implemented a 14-week periodized training program that focused on various components of strength training. Maximal strength training, with loads ranging from 65% to 100% of 1RM, was integrated into each micro cycle, along with isometric exercises. Additionally, explosive strength training activities such as ballistic training, plyometric, sprinting, and agility exercises were incorporated. The purpose of this periodized training program was to optimize the physical preparedness of MMA athletes. By progressively increasing volume and including specific exercises targeting strength and explosive power, the programme aimed to improve performance outcomes¹². Moreover, Ioannis N. Kostikiadis et al.'s research comparing two different training programmes (Specific Training Group and Regular Training Group) among experienced MMA fighters reveals that the Specific Training Group, following a sport-specific S&C training programme, displayed substantial improvements in various performance parameters. This further emphasizes the superiority of a tailored training approach over a regular programme for enhancing performance in MMA athletes¹³.

Furthermore, the computerized search conducted by Charalampos Spanias et al., provides valuable information on the physiological features of MMA competitors, such as body composition, strength, power, endurance, and aerobic and anaerobic capacity. This information can be utilized by S&C

trainers to design tailored training programmes and improve the performance and overall athletic ability of MMA competitors¹⁴.

Additionally, Oliver R. Barley et al.'s research provides valuable information about the training and competing habits of athletes in various combat sports and their potential relationship with competitive level. Understanding such patterns can help coaches, support staff, and regulators design effective training programmes and assess athlete performance¹⁵.

Overall, the collective findings highlight the crucial role of S&C in enhancing the performance of MMA athletes. They underscore the need for tailored and sport-specific training approaches, along with structured strength training programmes, to address the unique demands of MMA. The study also acknowledges the limitations of the current research, including small sample sizes and short intervention periods, and calls for further research with larger sample sizes and longer training interventions to gain a more comprehensive understanding of sports-specific S&C training in MMA.

Conclusion

In conclusion, the study assessing the impact of sport-specific S&C training on MMA participants found that the athletes' strength and power had significantly increased. The implementation of targeted training protocols tailored to the specific demands of MMA contributed to enhanced muscular strength, allowing athletes to generate greater force and exert more power in their techniques.

Athletes showed greater striking, grappling, and overall athletic ability as a result of their increased strength and power, which right away improved performance outcomes.

ISRB Approval: The study was granted by the ethical committee of Saveetha College of Physiotherapy, Tamil Nadu, India.

(ISRB NO: 01/039/2022/ISRB/PGSR/SCPT)

Funding: The authors declare that no funds, grants, or other support were received during the preparation of this manuscript.

Conflict of Interest: Nil

References

1. Gronek P, Wieliński D, Gronek J. Genetic and non-genetic determinants of aggression in combat sports. *Open Life Sciences*. 2014 Oct 2;10(1).
2. La Bounty P, Campbell BI, Galvan E, Cooke M, Antonio J. Strength and conditioning considerations for mixed martial arts. *Strength & Conditioning Journal*. 2011 Feb 1;33(1):56-67.
3. Lenetsky S, Harris N. The mixed martial arts athlete: a physiological profile. *Strength & Conditioning Journal*. 2012 Feb 1;34(1):32-47.
4. Bagley RJ, Arevalo AJ, Malyszek KK, Spencer AJ, Rosengarten J, Barillas SR, Leyva WD, McManus RT, Lee D, Galpin AJ. Skeletal muscle phenotype and performance of an elite mixed martial artist. *Medicine and Science in Sports and Exercise*; Lippincott Williams & Wilkins: Philadelphia, PA, USA. 2016.
5. Lovell DI, Bousson M, McLellan C. The use of performance tests for the physiological monitoring of training in combat sports: A case study of a world ranked mixed martial arts fighter. *J Athl Enhancement*. 2013;2(1):2-6.
6. Dawes J, Lentz D. Methods of developing power to improve acceleration for the non-track athlete. *Strength & Conditioning Journal*. 2012 Dec 1;34(6):44-51.
7. Spaniol FJ. Striking skills: Developing power to turn. *Strength & Conditioning Journal*. 2012 Dec 1;34(6):57-60.
8. Komi PV. Strength and power in sport.
9. Siff MC. Functional training revisited. *Strength & Conditioning Journal*. 2002 Oct 1;24(5):42-6.
10. Baechle TR, Earle RW, editors. *Essentials of strength training and conditioning*. Human kinetics; 2008.
11. Walker C. Effects of an eight week strength intervention on mixed martial arts techniques (Doctoral dissertation, University of Georgia).
12. Tota Ł, Drwal T, Maciejczyk M, Szyguła Z, Pilch W, Pałka T, Lech G. Effects of original physical training program on changes in body composition, upper limb peak power and aerobic performance of a mixed martial arts fighter. *Medicina Sportiva*. 2014 Apr 1;18(2):78-83.
13. Kostikiadis IN, Methenitis S, Tsoukos A, Veligekas P, Terzis G, Bogdanis GC. The effect of short-term sport-specific strength and conditioning training on physical fitness of well-trained mixed martial arts athletes. *Journal of sports science & medicine*. 2018 Sep;17(3):348.
14. Spanias C, Nikolaidis PT, Rosemann T, Knechtle B. Anthropometric and physiological profile of mixed martial art athletes: A brief review. *Sports*. 2019 Jun 14;7(6):146.
15. Barley OR, Harms CA. Profiling combat sports athletes: Competitive history and outcomes according to sports type and current level of competition. *Sports Medicine-Open*. 2021 Dec;7:1-2.