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Complex Training Methods and Maximal Strength: an Experimental Study on Judo Athletes

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Abstrak

Kekuatan maksimal merupakan salah satu komponen penting bagi atlet judo. Kekuatan yang maksimal membantu atlet dalam melakukan teknik melempar dengan baik saat bertanding. Oleh karena itu, diperlukan metode yang tepat untuk meningkatkan kekuatan maksimal atlet. Penelitian ini bertujuan untuk menguji pengaruh metode latihan kompleks terhadap kekuatan maksimal atlet judo, dimana metode latihan kompleks terbukti memberikan manfaat positif terhadap berbagai komponen kondisi fisik atlet. Metode eksperimen dengan menggunakan one-group pretest-posttest design digunakan dalam penelitian ini. Perlakuan berupa program latihan dengan metode latihan kompleks selama delapan minggu diberikan kepada 20 atlet judo Indonesia. Uji kekuatan maksimal menggunakan squat dan bench press dilakukan sebelum dan sesudah perlakuan. Analisis data dilakukan dengan menggunakan uji-t. Penelitian ini memberikan hasil yang menunjukkan bahwa metode latihan kompleks terbukti mampu meningkatkan kekuatan maksimal atlet judo secara signifikan. Selain itu, hasil juga menunjukkan adanya perbedaan persentase peningkatan antara atlet putra dan putri. Penelitian ini menyimpulkan bahwa metode latihan kompleks dapat dijadikan salah satu metode untuk meningkatkan kekuatan maksimal atlet judo.

Kata kunci: Metode Latihan Kompleks, Atlet Judo, Kekuatan Maksimal

Abstract

Maximal strength is one of the important components for judo athletes. Maximal strength helps athletes perform throwing techniques well when competing. Therefore, the right method is needed to increase the athlete's maximal strength. This study aims to examine the effect of complex training methods on the maximal strength of judo athletes, where complex training methods have been shown to provide positive benefits for various components of athletes' physical conditions. An experimental method using a one-group pretest-posttest design was used in this study. The treatment in the form of a training program using the complex training method for eight weeks was given to 20 Indonesian judo athletes. Maximal strength tests using squats and bench press were carried out before and after treatment. Data analysis was carried out using the t-test. This study provides results that show that the complex training method has been proven to be able to significantly increase the maximal strength of judo athletes. In addition, the results also show that there is a difference in the percentage of increase between male and female athletes. This study concludes that the complex training method can be used as one method to increase the maximal strength of judo athletes.

Keywords: *Complex Training Method, Judo Athlete, Maximal Strength*

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Introduction

Judo is a sport that emphasizes physical strength, technique, and strategy. The ability of judo athletes to apply techniques such as throws, locks, and other attacks depends heavily on their maximal strength. Maximal strength is one of the most important physical aspects in various types of sports, especially judo. This is very important for performing throw techniques and controlling opponents during matches, so athletes with the highest strength tend to have the ability to perform techniques more efficiently and effectively and have better endurance during matches (dharani et al., 2020; franchini et al., 2011). Maximal strength is one of the important components for judo athletes. Maximal strength helps athletes perform throwing techniques well when competing.

We all know that to increase the maximal strength of athletes, there are various training techniques that have been widely developed and can be applied, one of which is the complex

training technique. Complex training has gained popularity as a training strategy that combines weight training and plyometric training. In one training session, this technique combines plyometric training and heavy-weight training. The aim is to exploit the phenomenon of post-activation potentiation (PAP), which increases muscle performance (Tillin & Bishop, 2009; Wilson et al., 2013). Complex training is thought to simultaneously increase muscle strength and power. Therefore, it is ideal for sports such as judo, which require explosive power (Andersen et al., 2005).

The complex training method is one of the most effective methods for increasing maximal strength. Therefore, it is necessary to develop and apply this training method. To exploit the effects of post-activation potentiation (PAP), also known as increased muscle strength after heavy activity, this technique combines plyometric training and heavy weights (Tillin & Bishop, 2009). PAP can be used in strength training to increase the plyometric training stimulus (Docherty & Hodgson, 2007; Hodgson et al., 2005; Sale, 2004). According to research conducted (by Markovic & Mikulic, 2010), the complex training method can significantly increase the strength and explosive power of athletes' muscles in various sports, including judo, which can increase muscle strength and explosive power (Hughes et al., 2018).

In the process of increasing athletes' vertical strength and explosive power, plyometric training which is part of complex training has been proven successful. According to previous research, plyometric training increases the explosive power of basketball athletes (Santos & Janeira, 2011) and is related to maximal strength (Villarreal et al., 2009), which is able to help athletes show better performance. The positive results obtained certainly come from a well-structured complex training program based on an analysis of the needs and demands of athletes. Because if you don't put together the right training program, the implementation of complex training will not happen properly and of course will not provide maximum results for athletes.

However, it is important to consider the physiological differences between male and female athletes in response to training programs, especially in this complex training. The authors believe that complex training provides different physiological effects between male and female athletes, considering that physiological adaptations and characteristics between the two sexes are also different. Previous studies have shown that differences in muscle mass and muscle fiber distribution can affect strength training results (Komi & Bosco, 1978). Therefore, training programs must be adjusted to individual characteristics to maximize results (Clark et al., 2018), through different physiological responses. Therefore, this study aims to examine the effects of complex training methods on the maximal strength of judo athletes, where complex training methods have been shown to provide positive benefits for various components of athletes' physical condition.

Materials and Methods

An experimental method using a one-group pretest-posttest design was used in this study. Treatment in the form of a training program using a complex training method for eight weeks was given to 20 Indonesian judo athletes. Maximal strength tests using squats and benchpress were performed before and after treatment. Data analysis was carried out using the t-test.

Results and Discussion

The author presents the research results in the form of tables and figures to make them easier to understand. Maximal strength is a crucial aspect in judo, where the ability to generate maximal force is essential for the success of techniques in matches such as throws and locks (Franchini et al., 2011). In judo, maximal strength contributes to an athlete's ability to defeat an opponent effectively through strong and stable techniques. Therefore, increasing maximal strength can have a significant impact on an athlete's performance, especially in competitions that require strength and endurance (Ren et al., 2023). Maximal strength allows judo athletes to perform techniques more efficiently and effectively. Therefore, for a judo athlete, strength training not only improves the muscle's ability to generate force but also supports body stability and control when fighting an opponent (Franchini et al., 2011). According to previous studies, increasing maximal strength has a positive impact on sports performance, including sports such as judo, which require muscle strength for throws and locks (Hughes et al., 2018). Strength training performed by judo athletes must be able to help athletes have muscle strength that is at least two to three times their body weight in their match class to make it easier to get points in the match. Strength training performed must focus on the function or physiology of the body in performing sports performance, not just enlarging muscle diameter or increasing muscle mass.

In this study, the complex training applied provided positive benefits for judo athletes. Strength training dominated by plyometric training was able to increase the maximal strength of judo athletes. The results of this study strengthen previous research which revealed that complex training can increase the strength abilities of athletes (Villarreal et al., 2009). The results of this study are important considering that there are still many coaches who tend to apply conventional training methods or models because they are considered effective in increasing the maximal strength abilities of athletes, even though there are methods that are much more effective in increasing the maximal strength abilities of athletes, especially judo athletes, namely complex training (Makaruk et al., 2020). Complex training that combines several strength training exercises in one session is a distinct advantage in the judo training process because it has characteristics that are almost the same as the characteristics of judo matches.

In addition, the results of this study indicate that male and female athletes provide different physiological responses to complex training, where male athletes have a higher percentage of increase. These results can be influenced by variations in muscle mass and muscle fiber composition between men and women (Komi & Bosco, 1978). Therefore, to maximize results, the training program must be adjusted to the needs and demands of each individual (Clark et al., 2018), referring to the principle of individualized training. This means that coaches cannot provide the same program to male and female judo athletes because the needs of each athlete are different. If the training program given is the same, then there is a possibility that the training program may be lacking or excessive for certain athletes. Therefore, it is very important to be able to analyze the needs and demands of judo athletes referring to

the match to be faced. Complex training encourages neuromuscular adaptation which is very important to achieve maximal strength increases.

The study found that the combination of plyometric and strength training (commonly known as complex training) can increase muscle strength and endurance (Wilson et al., 2012). Another study also revealed that the integration of strength and plyometric training can effectively improve muscle strength and endurance (Lamas et al., 2012). Therefore, complex training is very beneficial for judo athletes, where maximal strength plays an important role in improving technical ability and showing the best performance. The results of this study can be a recommendation for coaches to be able to use complex training as an effective strategy to improve the maximal strength of judo athletes and help them achieve their best performance in matches.

Conclusion

This study concludes that the complex training method can be used to increase the maximal strength of judo athletes. This conclusion was obtained from the results of the research that has been conducted, where this complex training method has been proven to be significantly able to help judo athletes increase their maximal strength. Therefore, the author suggests that coaches apply complex training in the training process carried out, especially for judo athletes.

References

Andersen, L. L., Andersen, J. L., Magnusson, S. P., Suetta, C., Madsen, J. L., Christensen, L. R., & Aagaard, P. (2005). Changes in the human muscle force-velocity relationship in response to resistance training and subsequent detraining. *Journal of Applied Physiology*, *99*(1), 87–94. https://doi.org/10.1152/japplphysiol.00091.2005

Clark, M. A., Lucett, S. C., McGill, E., Montel, I., & Sutton, B. (2018). *NASM Essntials Of Personal Fitness Training* (Sixth Edit). Cathy L. Esperti.

Dharani, S., Wiriawan, O., & Mintarto, E. (2020). Pengaruh Latihan Pylometric terhadap Performa Olahraga: Kajian Literatur. *Jurnal Ilmiah Mandala Education*, *6*(2), 182–189. https://doi.org/10.58258/jime.v6i2.1405

Docherty, D., & Hodgson, M. J. (2007). The application of postactivation potentiation to elite sport. *International Journal of Sports Physiology and Performance*, *2*(4), 439–444. https://doi.org/10.1123/ijspp.2.4.439

Franchini, E., Del Vecchio, F. B., Matsushigue, K. A., & Artioli, G. G. (2011). Physiological profiles of elite judo athletes. *Sports Medicine*, *41*(2), 147–166. https://doi.org/10.2165/11538580-000000000-00000

Hodgson, M., Docherty, D., & Robbins, D. (2005). *Post-Activation Potentiation Motor Performance*. *35*(7), 585–595.

Hughes, D. C., Ellefsen, S., & Baar, K. (2018). Adaptations to endurance and strength training. *Cold Spring Harbor Perspectives in Medicine*, *8*(6), 1–18. https://doi.org/10.1101/cshperspect.a029769

Komi, P. V, & Bosco, C. (1978). Utilization of stored elastic energy in leg extensor muscles by men and women. *Med Sci Sports*, *10,4*(112), 261–265.

Lamas, L., Ugrinowitsch, C., Rodacki, A., Pereira, G., Mattos, E., Kohn, A. F., & Tricoli, V.

(2012). E Ffects of S Print and P Lyometrics T Raining. *Journal OfStrength and Conditioning Research*, *26*(12), 3335–3344. https://doi.org/DOI: 10.1519/JSC.0b013e318248ad16

Makaruk, H., Starzak, M., Suchecki, B., Czaplicki, M., & Stojiljković, N. (2020). The effects of assisted and resisted plyometric training programs on vertical jump performance in adults: A systematic review and meta-analysis. *Journal of Sports Science and Medicine*, *19*(2), 347–357.

Markovic, G., & Mikulic, P. (2010). Neuro-musculoskeletal and performance adaptations to lower-extremity plyometric training. *Sports Medicine*, *40*(10), 859–895. https://doi.org/10.2165/11318370-000000000-00000

Ren, M., Tian, Y., Mcneill, C., & Lenetsky, S. (2023). The Role and Development of Strength for Elite Judo Athletes. *Strength & Conditioning Journal*. https://doi.org/https://doi.org/10.1519/ssc.0000000000000778

Sale, D. (2004). Postactivation potentiation: Role in performance. *British Journal of Sports Medicine*, *38*(4), 386–387. https://doi.org/10.1136/bjsm.2002.003392

Santos, E. J. A. M., & Janeira, M. A. A. S. (2011). The effects of plyometric training followed by detraining and reduced training periods on explosive strength in adolescent male basketball players. *J Strength Cond Res*, *25*(2), 441–452. https://doi.org/doi: 10.1519/JSC.0b013e3181b62be3.

Tillin, N., & Bishop, D. J. (2009). Factors Modulating Post-Activation Potentiation and its effects on performance. *Sports Medicine*, *39*(2), 147–166.

Villarreal, E. S.-S. de, Kellis, E., Kraemer, W. J., & Izquierdo, M. (2009). Determining variables of plyometric training for improving vertical jump height performance: a meta-analysis. *J Strength Cond Res*, 495–506. https://doi.org/doi: 10.1519/JSC.0b013e318196b7c6.

Wilson, J. M., Duncan, N. M., Marin, P. J., Brown, L. E., Loenneke, J. P., Wilson, S. M. C., Jo, E., Lowery, R. P., & Ugrinowitsch, C. (2013). Meta-Analysis of Postactivation Potentiation and Power. *Journal of Strength and Conditioning Research*, *27*(3), 854–859. https://doi.org/10.1519/jsc.0b013e31825c2bdb

Wilson, J. M., Loenneke, J., Jo, E., Wilson, G. J., Zourdos, M. C., & Kim, J.-S. (2012). The Effects of Endurance, Strength, and Power Training on Muscle Fiber Type Shifting. *Journal of Strength and Conditioning Research*, *26(6)*(49), 1724–1729. https://doi.org/DOI: 10.1519/JSC.0b013e318234eb6f