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ORIGINAL SCIENTIFIC ARTICLE

DOES THE ATHLETES' LEG MUSCLE POWER INCREASE AFTER THE TABATA AQUATIC PROGRAM?

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Abstract

The study purpose. This study aims to evaluate the effect of the Tabata aquatic training method program in increasing the muscle power of beginner level athletes.

Materials and methods. The researcher used a mixed method in this study. There were twenty swimming athletes (n = 20, age: 14.40 ± 1.18 years, height: 169.20 ± 3.18 cm, weight: 62.20 ± 2.26 kg) who agreed to participate in this study and were divided into two groups. The treatment group (n = 10) received the Tabata aquatic program and the control group (n = 10) swam every day without participating in any physical activity. The Tabata aquatic program was carried out for 9 weeks with a frequency of 3 times a week. After implementing the Tabata aquatic program, 10 athletes were interviewed. This study applied a quantitative research instrument, including squat jumps, and a qualitative research instrument, including individual in-depth interviews lasting for 30 minutes each. Analysis of quantitative data using IBM SPSS version 25.0 and qualitative data using thematic analysis was applied.

Results. Quantitative study results showed that there was a significant increase in the squat jumps test (leg muscle power) in the treatment group and vice versa, there was no increase in the control group. However, in qualitative research results, most participants mentioned that the Tabata aquatic program is a fun training method and has a positive effect.

Conclusions. After carrying out the Tabata aquatic program for 9 weeks, we confirmed that this training method has a great impact on improving athletes' leg muscle power in swimming.

Keywords: Leg muscle power, Tabata aquatic, Swimming athletes, Mixed methods.

Introduction

Muscle power is a product of force and movement speed that plays an important role in athlete performance in all competitive sports, such as basketball, martial arts, soccer and swimming (Loturco et al., 2015)which influences sports performance. However, the traditional determination of the specific workload at which power production is maximized (i.e., optimum power load. Previous studies reported that a great muscle power resulted a long throw in shot put training (Zaras et al., 2013). Similar results were shown in judo, a great muscle power could improve athletes' performance much better in the competition (Campos et al., 2018). In sports like soccer, muscle power plays a key component to generate a hard kick (Burhaein, Ibrahim & Pavlovic, 2020). A study conducted by Alricsson, Björklund, Ekström & Östenberg (2016) reported that athletes' experienced a decline in physical condition in the era before and during COVID-19 (Setiawan, Iwandana, Festiawan & Bapista, 2020). Based on these facts and data, athletes and coaches need to find an appropriate training method to increase muscle power.

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Nowadays, Tabata training or known as high intensity interval training (HIIT) (Biddle & Batterham, 2015; Foster et al., 2015; Tabata, 2019; becomes popular in among athletes and coaches in several countries (Evangelista et al., 2017; Murawska-Cialowicz et al., 2020) obesity, type-2 diabetes. Tabata is a method that combines high-intensity exercise and rest (Joo, 201515.3 ± 1.2; the final bout, 18.6 ± 0.9; P< 0.001; Sumpena & Sidik, 2016). Tabata training works in 20 seconds intervals of high intensity exercise and 10 seconds for rest and repeated 8 times for a total of 4 minutes (Ekström, Ostenberg, Björklund & Alricsson, 2017). Previous studies reported that the Tabata training method had an effect on increasing muscle power (Gillen & Gibala, 2014). A recent study has proven that Tabata training method is effective for improving physical fitness in handball athletes (Setiawan et al., 2020) and martial arts (Patah et al., 2021). Another advantage of the Tabata training method that has been reported is the ability to increase V02max endurance (Greenlee et al., 2017) and reduce obesity rates (Burhaein et al., 2020). The effects of the Tabata training method have been reported internationally by researchers in various countries (Kong et al., 2016; Wewege et al., 2018; Torma et al., 2019). However, the analysis focused only on traditional Tabata-based training methods or often performed in closed or open spaces, while this research focuses more on evaluating Tabata aquatic which is a training or physical activity carried out in a water with or without music (Rýzková, Labudova, Grznar & Smida, 2018). The Tabata aquatic training method should be carried out twice a week and each exercise must reach an intensity load of 50-85% HRmax (Rebold, Kobak & Otterstetter, 2013). Previous studies have found that Tabata aquatic is effective in improving cardiorespiratory fitness (Mcdaniel et al., 2020). However, as far as we know this research is the first work that evaluate Tabata aquatic training method to increase the leg muscle power of swimming athletes. In addition, our study presents different method from previous studies, namely a mixed method in an effort to evaluate the effect of Tabata aquatic training method has based on a quantitative and qualitative perspective. This research has implications as a valuable information or reference for coaches, lecturers and athletes regarding the importance of using the Tabata aquatic training method and being a solution for trainers about methods that can be used during the COVID-19 pandemic. Therefore, this study aims to evaluate the effect of Tabata aquatic training method on improving athletes' leg muscle power.

Materials and Methods

Participants

This study used a mixed method, which is a type of research that combines quantitative (experimental) and qualitative (in-depth interviews) method. Based on data from previous studies, it shows that mixed method was effective for uncovering and overcoming a problem.

Participants was taken from 20 beginner level swimming athletes in Karawang Regency (age: 14.40 ± 1.18 years, height: 169.20 ± 3.18 cm, weight: 62.20 ± 2.26 kg). Participants were divided into an treatment group (Tabata aquatic group, n = 10), in which the training program was carried out in the water for 9 weeks and a control group (CG, n = 10), in which the participants performed their daily swimming exercise routine or without followed any physical exercise program for 9 weeks. Before starting this research, all participants were asked to write a statement letter about their willingness to participate in all activities in this study. This study was approved by the Indonesian National Sports Committee Karawang Regency (E-177/9/2021) and in accordance with the World Medical Association Code of Ethics (Helsinki Declaration for humans).

Instruments

Quantitative Instruments

In this mixed method study, the instrument for measuring the level of leg muscle power was squat jumps (SJ) (Alemdaroğlu, 2012). All participants work on SJ in twice trials and the best score was used for statistical analysis (García-Pinillos, Camara-Perez, Soto-Hermoso & Latorre-Roman 2017).

Qualitative Instruments

Meanwhile, the qualitative instrument used in-depth interviews with participants with a duration of 30 minutes per person. Interviews were conducted directly and used Bahasa language.

Study organization

This mixed research was conducted from September until October 2021 in Karawang district (Indonesia). There were several meetings that had been held for quantitative research. The first meeting was conducted on September 15, 2021, with 20 participants involved in initial test activities (SJ) and swimming tests. The second meeting on September 8, 2021, the treatment group carried out the Tabata aquatic training program until the 21st meeting (22 October 2021). The 22nd meeting (24 October 2021), all participants carried out the final test activity, namely SJ. The Tabata aquatic training is held in the morning in the swimming pool located at Singaperbangsa University Karawang (Indonesia). This study strictly implement COVID-19 health protocol, for example, all participants and the research team were checked for body temperature and used hand sanitizer prior training. While, the qualitative research was carried out on 27 and 29 October 2021, the treatment group were interviewed for 30 minutes each and the interviews were conducted using Bahasa. The Tabata aquatic program is presented in Table 1.

Table 1. Tabata aquatic program

Training Unit Components	Exercise Activities	Duration
Warm-up	Prestretch and cardiorespiratory warm-up (e.g. Jogging).	10 min
Focus on practice	Exercise is done at high intensity for 20 seconds for one form of exercise and 10 seconds for rest. Tabata aquatic program: Squat jump, jumping jack, barrier hop, high knee.	4 min
Cool-down	Cardiorespiratory cool down and the poststretch.	10 min

Statistical analysis

Quantitative analysis

Normality and homogeneity testing used Shapiro-Wilk analysis and Levene Test ($p > 0.05$). While the descriptive statistics ($M \pm SD$) and the difference in the pre-test and post-test SJ scores of the Tabata aquatic and control groups were tested using Independent Sample t-test analysis. The level applied in this study was $p < 0.05$, which means it is accepted as significant. The size of effect size was calculated as follows: small d: <0.5, medium d: 0.5-0.79 and large d: >0.85. All data were analyzed using the IBM SPSS tool (version 25.0).

Qualitative analysis

The qualitative analysis in this study was thematic, the results of in-depth interviews were coded and categorized into three themes (Ekström, Ostenberg, Björklund & Alricsson 2017), namely: theme 1: Tabata aquatic training experience, theme 2: benefits of training Tabata aquatic and theme 3: disadvantages of Tabata aquatic training.

Results

The normality test results were normally distributed ($p = 0.110>0.05$), similar with homogeneity test ($p = 0.126>0.05$). In the pre-test and post-test of SJ, the Tabata aquatic group showed a significant increase ($p = 0.002<0.05$), it was indicated by the size of effect ($d = 0.76$) (Table 2). Meanwhile, the control group showed that there was no improvement in SJ ($p = 0.567>0.05$) and effect size ($d = 0.00$).

The results of qualitative research through in-depth interviews with participants obtained the following results:

Theme 1: Tabata Aquatic Training Experience

Most of the participants mentioned that "the application of Tabata aquatic makes us feel satisfied and fun while doing leg muscle power training. In addition, we feel Tabata aquatic is the right method to increase leg muscle power during the current pandemic crisis."

While some of the participants stated that "Tabata aquatic provides a lot of training or movement experience for us and we also feel very enthusiastic in practicing because it is accompanied by music."

And the rest argued that "Tabatata aquatic training accompanied by music, so it cause us to not feel bored while doing the exercises. And we agreed to continue using Tabata aquatic to increase our muscle power, even though this research has been completed."

Theme 2: Benefits of Tabata Aquatic Training

Most of the participants expressed the opinion that "The benefits of applying the Tabata aquatic training method are it is easy to implement and fun."

While some argue that "Tabata aquatic increases the muscle mass of our leg, so our swimming speed becomes better."

Some argue that "The Tabata aquatic training method has a better efficiency rate than other types of training or this training can save more time."

Theme 3: Disadvantages of Tabata Aquatic Training

Most of the participants argued that "If physical fitness is not in good condition, Tabata aquatic will pose a risk of injury to the user."

Then some argue that "When going to do Tabata aquatic training it is better to do optimal warm-up, because high-intensity training is possible to cause injury or leg cramps."

Discussion

The objective of this study was to evaluate the effect of the Tabata aquatic training method on increasing athlete's leg power. The main finding in our quantitative study showed that the Tabata aquatic (EG) training method which had been carried out for 9 weeks has a positive effect on increasing leg muscle power (7-10% muscle performance), thus increasing the speed in swimming athletes. The improvement in high muscle power occured because Tabata performed in water (aquatic) has a heavier load than Tabata performed on land, thus requiring the muscles to work more optimally (D'Acquisto et al., 2015). In addition, the form of exercise or movement used in the Tabata aquatic program is explosive with high intensity (80-90%) and it is the key to success in triggering an increase in the power aspect (Fajrin, Kusnanik & Wijono, 2018). Similarly, research by García-Pinillos et al. (2017) found that HIIT/Tabata training resulted in an increase in muscle performance (6-9%), sprint performance, speed swimming and cycling. Even, Herbert et al. (2017) reported that conducted Tabata for 6 weeks can increase the muscle power of master level athletes. On the other hand, the control group (CG) did not show a significant increase in leg muscle power.

While in qualitative research show that most athletes agreed that the Tabata aquatic method is a very fun and not boring exercise because it is accompanied by energetic music and of course this training has a positive effectiveness for improving the condition of leg muscle power possessed by swimming athletes. The results of this study are in line with

Table 2. Differences values in pre-test and post-SJ in the EG and CG groups

Dependent Variable	EG				CG			
	Pre-Test	Post-Test	p	ES (d)	Pre-Test	Post-Test	p	ES (d)
	Mean(SD)	Mean(SD)			Mean(SD)	Mean(SD)		
SJ	42.0 (9.3)	52.8 (11.4)	0.002	0.76	35.2 (4.1)	34.4 (3.9)	0.567	0.011

SJ: Squat Jumps, SD: Standard Deviation, EG: Eksperimental Group, CG: Control Group, p: Signifikansi; ES (d): Effect Size (Cohen's d)

previous studies (García-Pinillos et al., 2017). For example, an aquatic-based Tabata performed for 10 weeks was effective to improve the physical fitness of students (Rýzková et al., 2018).

In summary, our research has implications for providing alternative methods for swimming and other researcher could use this study as a reference for further research. In addition, according to the training effect size, Tabata aquatic has a moderate effect on increasing the leg muscle power of beginner level swimming athletes. Future studies are interesting to follow up, for example comparing the Tabata aquatic training method with Tabata that conducted on land.

Conclusions

Based on the results and findings in this study, it can be concluded that the Tabata Aquatic training method program has been shown to have an effect on increasing leg muscle power. However, this study still has limitations, namely the limited number of participant and scope is relatively small, only from one sport. Therefore, it is suggested further studies need to be carried out with many athletes from other sports. This research has implications for being a solution for coaches to improve the physical condition of athletes during the COVID-19 pandemic crisis and provide information for lecturers, coaches, students or athletes about the importance of using the Tabata aquatic training method.

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Conflict of interest

All researchers declare that there is no conflict of interest in this research.

References

Loturco, I., Nakamura, F. Y., Tricoli, V., Kobal, R., Abad, C. C. C., Kitamura, K., Ugrinowitsch, C., Gil, S., Pereira, L. A., & González-Badillo, J. J. (2015). Determining the optimum power load in jump squat using the mean propulsive velocity. *PLoS ONE, 10*(10), 1-12. https://doi.org/10.1371/journal.pone.0140102

Zaras, N., Spengos, K., Methenitis, S., Papadopoulos, C., Karampatsos, G., Georgiadis, G., Stasinaki, A., Manta, P., & Terzis, G. (2013). Effects of strength vs. Ballistic-power training on throwing performance. *Journal of Sports Science and Medicine, 12*(1), 130-137. http://www.jssm.org

Campos, B. T., Cabido, C. E. T., Soares, Y. M., Pedrosa, G. F., Mendes, T. T., & de Almeida, R. S. V. (2018). Exercício preparatório de força isométrico aumenta o desempenho de potência muscular de judocas. *Journal of Physical Education (Maringa), 29*(1), 1-8. https://doi.org/10.4025/jphyseduc.v29i1.2910

Burhaein, E., Ibrahim, B. K., & Pavlovic, R. (2020). The relationship of limb muscle power, balance, and coordination with instep shooting ability: A correlation study in under-18 football athletes. *International Journal of Human Movement and Sports Sciences, 8*(5), 265-270. https://doi.org/10.13189/saj.2020.080515

Alricsson, M., Björklund, G., Ekström, A., & Hafsteinsson Östenberg, A. (2016). Introducing Tabata intervals and stability exercises in school children by a school-based study. *European Journal of Public Health, 26*(suppl_1). https://doi.org/10.1093/eurpub/ckw174.222

Setiawan, E., Iwandana, D. T., Festiawan, R., & Bapista, C. (2020). Improving handball athletes' physical fitness components through Tabata training during the outbreak of COVID-19. *Jurnal SPORTIF, 6*(2), 375-389. https://doi.org/10.29407/js_unpgri.v6i2.14347

Biddle, S. J. H., & Batterham, A. M. (2015). High-intensity interval exercise training for public health: A big HIT or shall we HIT it on the head? *International Journal of Behavioral Nutrition and Physical Activity, 12*(1), 1-8. https://doi.org/10.1186/s12966-015-0254-9

Foster, C., Farland, C. V, Guidotti, F., Harbin, M., Roberts, B., Tuuri, A., Doberstein, S. T., & Porcari, J. P. (2015). The Effects of High Intensity Interval Training vs Steady State Training on Aerobic and Anaerobic Capacity. *Journal of Sports Science and Medicine, 14*(August), 747-755.

Tabata, I. (2019). Tabata training: one of the most energetically effective high-intensity intermittent training methods. *Journal of Physiological Sciences, 69*(4), 559-572. https://doi.org/10.1007/s12576-019-00676-7

Evangelista, A. L., Evangelista, R. A. G. d. T., Rica, R. L., Machado, A. F., Miranda, J. M. Q., Teixeira, C. V. L. S., Lopes, C. R., & Bocalini, D. S. (2017). Effects of high-intensity calisthenic training on mood and affective responses. *Journal of Exercise Physiology Online, 20*(6), 15-23. https://www.asep.org/resources/jep-online/

Murawska-Cialowicz, E., Wolanski, P., Zuwala-Jagiello, J., Feito, Y., Petr, M., Kokstejn, J., Stastny, P., & Goliński, D. (2020). Effect of hiit with tabata protocol on serum irisin, physical performance, and body composition in men. *International Journal of Environmental Research and Public Health, 17*(10), 1-15. https://doi.org/10.3390/ijerph17103589

Joo, C. H. (2015). Development of a non-damaging high-intensity intermittent running protocol. *Journal of Exercise Rehabilitation, 11*(2), 112-118. https://doi.org/10.12965/jer.15195

Sumpena, A., & Sidik, D. (2016). The Impact of Tabata Protocol to Increase the Anaerobic and Aerobic Capacity. *Journal of Physics: Conference Series, 755*(1). https://doi.org/10.1088/1742-6596/755/1/011001

Ekström, A., Östenberg, A. H., Björklund, G., & Alricsson, M. (2017). The effects of introducing Tabata interval training and stability exercises to school children as a school-based intervention program. *International Journal of Adolescent Medicine and Health, 31*(4), 1-11. https://doi.org/10.1515/ijamh-2017-0043

Gillen, J. B., & Gibala, M. J. (2014). Is high-intensity interval training a time-efficient exercise strategy to improve health and fitness? *Applied Physiology, Nutrition and Metabolism, 39*(March), 409-412. https://doi.org/10.1139/apnm-2013-0187

Patah, I. A., Jumareng, H., Setiawan, E., Aryani, M., & Gani, R. A. (2021). The importance of physical fitness for pencak silat athletes : Home-based weight training tabata and circuit can it work ? *Journal Sport, 6*(1), 86-97. https://doi.org/10.25299/sportarea.2021.vol6(1).6172

Greenlee, T., A., Greene, D., Ward, N., Reeser, G., Allen, C., Baumgartner, N., Cohen, N., Kramer, A., Hillman, C., & Barbey, A. (2017). Effectiveness Of A 16-Week High-Intensity Cardioresistance Training Program In Adults. *The Journal of Strength and Conditioning Research, 31*(9), 2528-2541. https://doi.org/10.1519/JSC.0000000000001976

Kong, Z., Sun, S., Liu, M., & Shi, Q. (2016). Short-Term High-Intensity Interval Training on Body Composition and Blood Glucose in Overweight and Obese Young Women. *Journal of Diabetes Research,* 4073618, 10-12. https://doi.org/10.1155/2016/4073618

Wewege, M. A., Ahn, D., Yu, J., Liou, K., & Keech, A. (2018). High-Intensity Interval Training for Patients With Cardiovascular Disease – Is It Safe? A Systematic Review. Journal of the American Heart Association, 7(21), 1-19. https://doi.org/10.1161/JAHA.118.009305

Torma, F., Gombos, Z., Jokai, M., Takeda, M., Mimura, T., & Radak, Z. (2019). High intensity interval training and molecular adaptive response of skeletal muscle. *Sports Medicine and Health Science, 1*(1), 24-32. https://doi.org/10.1016/j.smhs.2019.08.003

Rýzková, E. V. A., Labudová, J., Grznár, Ľ., & Šmída, M. (2018). Original Article Effects of aquafitness with high intensity interval training on physical fitness. *Journal of Physical Education and Sport, 18*(1), 373-381. https://doi.org/10.7752/jpes.2018.s151

Rebold, M. J., Kobak, M. S., & Otterstetter, R. (2013). The influence of a Tabata interval training program using an aquatic underwater treadmill on various performance variables. *Journal of Strength and Conditioning Research, 27*(12), 3419-3425. https://doi.org/10.1519/JSC.0b013e3182908a09

Mcdaniel, B. B., Naquin, M. R., Sirikul, B., & Kraemer, R. R. (2020). Five Weeks of Aquatic-Calisthenic High Intensity Interval Training Improves Cardiorespiratory Fitness and Body Composition in Sedentary Young Adults. *Journal of Sports Science and Medicine, 19*(1), 187-194. https://doi.org/10.1249/01.mss.0000563036.95297.1d

Alemdaroğlu, U. (2012). The Relationship Between Muscle Strength, Anaerobic Performance, Agility, Sprint Ability and Vertical Jump Performance in Professional Basketball Players. J*ournal of Human Kinetics, 31*(March), 99-106. https://doi.org/10.2478/v10078-012-0016-6

García-Pinillos, F., Cámara-Pérez, J. C., Hermoso, V. M., & Latorre-Román, P. Á. (2017). A High Intensity Interval Training (HIIT)-Based Running Plan Improves Athletic Performance by Improving Muscle Power. *Journal of Strength and Conditioning Research, 31*(1), 146-153. https://doi.org/10.1519/JSC.0000000000001473

D'Acquisto, L. J., Miller, L. J., D'Acquisto, D. M., Roemer, K., & Fisher, M. G. (2015). Physiological and Psychophysical Aspects of Shallow Water Exercise. *International Journal of Aquatic Research and Education, 9*(3). https://doi.org/10.25035/ijare.09.03.05

Fajrin, F., Kusnanik, N. W., & Wijono. (2018). Effects of High Intensity Interval Training on Increasing Explosive Power, Speed, and Agility. *Journal of Physics: Conference Series,* 947, 012045. https://doi.org/10.1088/1742-6596/947/1/012045

Herbert, P., Hayes, L., Sculthorpe, N., & Grace, F. (2017). HIIT produces increases in muscle power and free testosterone in male masters athletes. *Endoc Rine Connec Tions, 6*(7), 430-436. https://doi.org/10.1530/EC-17-0159

ЧИ ЗБІЛЬШУЄТЬСЯ СИЛА М'ЯЗІВ НІГ СПОРТСМЕНІВ ПІСЛЯ ЗАСТОСУВАННЯ ВОДНОЇ ПРОГРАМИ ТАБАТА?

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Авторський вклад: A – дизайн дослідження; B – збір даних; C – статаналіз; D – підготовка рукопису; E – збір коштів

Реферат. Стаття: 6 с., 2 табл., 28 джерел.

Мета дослідження – оцінити вплив програми водних тренувань Табата на збільшення м'язової сили спортсменів-початківців.

Матеріали і методи. У даному дослідженні використано змішаний метод. Двадцять спортсменів-плавців (n = 20, вік: 14,40 ± 1,18 років, зріст: 169,20 ± 3,18 см, маса тіла:

62,20 ± 2,26 кг) погодилися взяти участь у дослідженні та були розділені на дві групи. Експериментальна група (n=10) займалася за водною програмою Tabata, а контрольна група (n = 10) займалася плаванням щодня без будь-якої іншої фізичної активності. Водна програма Табата застосовувалася протягом 9 тижнів 3 рази на тиждень. Після впровадження водної програми Табата було опитано 10 спортсменів. У дослідженні використовувався кількісний аналіз, який включав присідання з вистрибом, та якісний аналіз, який включав індивідуальні докладні опитування тривалістю 30 хвилин кожне. Кількісні дані було проаналізовано за допомогою IBM SPSS версії 25.0 та якісні дані – за допомогою тематичного аналізу.

Результати. Результати кількісного дослідження показали значне збільшення показників у тесті «Присідання з вистрибом» (сила м'язів ніг) в експериментальній групі і, навпаки, у контрольній групі збільшення не спостерігалось. Однак, за результатами якісного дослідження, більшість учасників відзначили, що водна програма Табата є цікавим методом тренувань і має позитивний вплив.

Висновки. Після застосування водної програми Табата протягом 9 тижнів ми підтвердили, що цей метод тренувань має великий вплив на покращення сили м'язів ніг спортсменів-плавців.

Ключові слова: сила м'язів ніг, водна Табата, спортсмени-плавці, змішані методи.

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