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A RANDOMIZED CONTROLLED TRIAL OF THE EFFECTIVENESS OF THE FITT PRINCIPLE USING KNEE TUCK JUMP EXERCISES IN INCREASING LEG POWER

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Abstract.
This research is based on the background of volleyball athletes master volleyball ball club when doing smash the jump is not optimal, as well as when blocking the opponent's smash range is higher than the blocking so it is easy to penetrate. This research was conducted with a quantitative approach with a preexperimental design method with a two-group pretest-posttest design. The sample in this study were 20 volleyball master volleyball ball club athletes. Treatment uses the principles of Frequency, Interval, Time and Type (FITT). Frequency is no more than 2x24 hours, intervals use the principle of submaximal intensity sets and reps, time uses duration based on the increase in heart rate beat per minute (bpm), type uses the aerobic glycolysis energy system. The results of the study were then processed using IBM SPSS 23. While the results of the knee tuck jump 93.10 became 99.00 paired sample T-test hypothesis test on pretest data and posttest data obtained sig value (2-tailed) = 0.002. Based on the results of the study, the application of knee tuck jump training has an effect on increasing leg power.

Keywords: training, fitt, knee tuck jump, leg power, volleyball

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INTRODUCTION

In the sport of volleyball, physical strength is one of the main factors that affect athlete performance. One important aspect is leg muscle power, which plays a role in various explosive movements such as jumps to spike or block, as well as fast movements on the court. Good leg muscle power allows athletes to jump higher and faster, providing a competitive advantage especially in game situations that require a lightning response (Fayogi et al., n.d.). Therefore, the development of leg muscle power is a priority in the training program of volleyball athletes.

Physiologically, leg muscle power refers to the combination of strength and speed produced by the leg muscles (Grachan, 2021). In volleyball, muscles such as the quadriceps, hamstring, and gastrocnemius work synergistically to create explosive movements. Exercises that focus on increasing strength such as squats, plyometrics, and dynamic weight training have proven effective in improving jumping performance and movement accuracy. In addition, optimal playing technique also depends on athletes' ability to utilize their leg muscle power efficiently.

The need for leg muscle power in volleyball is also related to the dynamic demands of the game. Athletes must be able to move quickly to catch the ball, jump high to block an opponent's attack, and defend stably in a certain position. An imbalance or lack of leg muscle power can reduce the athlete's ability to carry out their strategic role, even potentially increasing the risk of injury (Glynn, 2022). Therefore, it is important for athletes and coaches to understand and implement a structured training program to optimize leg muscle strength and endurance.

The FITT principle (Frequency, Intensity, Time, and Type) is an effective guideline in designing a structured and measurable physical exercise program (Lemos, 2020; Wibisana & Royana, 2023). Frequency refers to the number of training sessions in a week. The ideal frequency is tailored to the training goals and physical condition of the individual. Intensity is an important factor that determines the level of load or effort exerted during exercise. Intensity should be tailored to the individual's abilities and targets. For aerobic exercise, intensity is usually measured using heart rate or perceived level of effort (RPE). Time and Type complete the application of the FITT principle in physical training. The duration of exercise (time) should be sufficient to achieve benefits without causing excessive fatigue, the type of exercise (type) is chosen based on specific goals, such as cardiovascular exercise to improve endurance, weight training for strength, or functional exercise for mobility (Alexander et al., 2021).

The right combination of the four elements in the FITT principle helps to create an exercise program that is effective, safe, and suited to individual needs, thereby maximizing the results to be achieved.

Much research has been conducted on the effectiveness of the FITT principle in physical training programs, particularly in the context of developing muscular strength and explosive power (Jonvik, 2020). However, there is a research gap in its specific application to explosive exercises such as the knee tuck jump to increase leg power in volleyball athletes. Most studies focus more on plyometric exercises in general, such as box jump or depth jump, without exploring the specific role of knee tuck jump which also has high potential in the development of explosive strength of leg muscles.

The knee tuck jump is a simple plyometric exercise that demands intensive leg muscle work, involving the quadriceps, hamstring and gastrocnemius muscles in explosive movements (Wibisana, 2020) . Despite its effectiveness, there is a lack of research that specifically evaluates how the elements of the FITT principle (frequency, intensity, duration, and type of exercise) can be optimized to maximize the benefits of the knee tuck jump. Existing studies often do not provide sufficiently detailed data regarding the ideal intensity, duration of training, or the effects of frequency variation on leg power gains, particularly for volleyball athletes with high explosive movement demands.

In addition, research on the knee tuck jump in the context of volleyball often lacks the integration of athletes' specific needs, such as the transfer of training results to game performance, for example, jumping during a spike or block. The influence of this exercise on movement biomechanics

and energy efficiency in matches has also not been widely studied. By filling this research gap, a FITT-based training program using the knee tuck jump can be designed more effectively, making a significant contribution to the development of training methodologies for volleyball athletes to optimally improve their leg power..

METHOD

The subjects in this research were 20 participants in the leg power courses in the Master Voli Ball Club. In this study, the authors conducted quantitative research using the pre-experimental method of randomized controlled trial design with pretest-posttes. That design is a research activity that gives an initial test (pretest) before being given treatment, after being given treatment then gives a final test (posttest) (Sugiyono, 2017). This pretest-posttest design consists of one predetermined group.

O1 : Initial test (Pretest before treatment)

O1 X O2

X : Treatment using the FITT method

O2 : Final test (Postest after treatment)

The sample in this study used purposive sampling with a total of 20 students with criteria: active athelete, doing training in the club at least three times a week and committing to be research volunteers during the treatment process. Pretest and posttest using vertical jump test instrument to measure leg power (Blackwell, 2015). the treatment process is carried out for 14 meetings with the FITT method. Frequency in this treatment is the number of meetings in accordance with endurance needs, namely 2 meetings a week. Intensity refers to how hard you do the exercise. Exercise intensity can be measured based on heart rate, speed, weight lifted, or the level of fatigue you feel, this treatment uses submaximal intensity. Time or duration refers to how long to do the exercise each session. This treatment is done for 45 minutes per session or meeting. Type refers to the type of exercise performed, this treatment uses the game season method with the application of knee tuck jump.

Statistical analysis.

Statistical analysis using the effect of FITT method knee tuck jump variables on leg power capacity with paired sample tests and viewing the percentage of improvement after treatment.

RESULT AND DISCUSSION

The research was conducted on Master Voly Ball Club (MAVOC) volleyball athletes totaling 20 athletes. Analysis of research data using the results of the prerequisite test. Prerequisite tests are carried out to ascertain whether the data being analyzed is suitable for analysis and hypothesis testing. This prerequisite test includes a normality test using the Kolmogorov-Smirnov test and a homogeneity test using the Lavene statistical test. The following statistical test results on the Knee Tuck Jump

Exercise obtained data at the time of the pretest and posttest are presented and analyzed in the data as follows:

Table 1 Descriptive Statistic Knee Tuck Jump Training

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Knee Tuck Jump pre	10	79	115	93.10	9.632
Knee Tuck Jump post	10	84	133	99.00	13.081
Valid N (listwise)	10				

Sumber : Analisis data

Based on the table obtained, the average result before the Knee Tuck Jump exercise on leg power at the Volleyball Master Volleyball Club is 93.10 with a standard deviation or std deviation of 9.632, a maximum value of 115 and a minimum value of 79. The average result after Knee Tuck Jump training on leg power at the Volleyball Master Volleyball Club is 99.00 with a standard deviation or std deviation of 13.081, a maximum value of 133 and a minimum value of 84.

Table 2 Normality Knee Tuck Jump Training

Data	N	Std. Deviation	Mean	Sig	Keterangan
Latihan knee tuck jump	10	2.371	0.000	0.200	Normal

Sumber : Analisis data

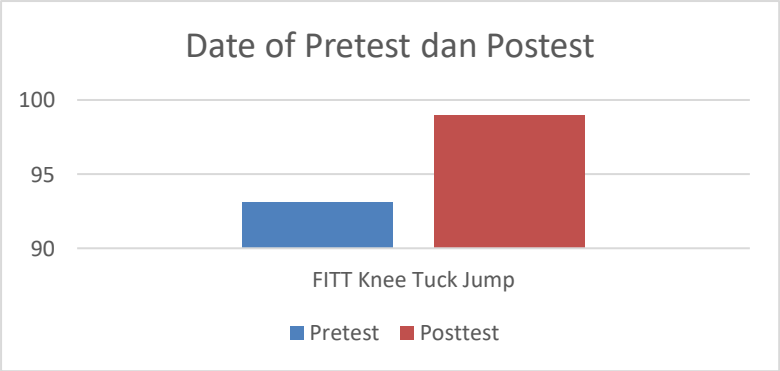
Based on the normality results obtained with a significance level of 0.05, it shows that the significance value of Knee Tuck Jump training on leg power at the Volleyball Master Volleyball Ball Club is 0.200>0.05, so the data is normally distributed. So it can be concluded that the Knee Tuck Jump training data on leg power at the Volleyball Master Volleyball Ball Club club is normally distributed.

Table 3 Homogenity Knee Tuck Jump Training

Data	N	Std. Deviation	Mean	Sig	Keterangan
Latihan knee tuck jump	10	2.371	0.000	0.200	Normal

Sumber : Analisis data

Based on the results of the homogeneity test with a P value sig of 0.633> 0.05, the data is homogeneous. It can be concluded that the results of data homogeneity data are homogeneous.



Based on the results of the hypothesis test above, for the pretest and posttest results of leg power using knee tuck jump training at the Volleyball Master Volleyball Ball Club, it was obtained that the

sig value (2- tailed) = 0.002 <0.05 which means Ha is accepted, with the conclusion that there is an effect of knee tuck jump training on increasing leg power in the Volleyball Master Volleyball Ball Club. While the pretest and postest results show an increase from 93.10 to 99.00 or an increase of 6.34%..

Discussion

The FITT principle (Frequency, Intensity, Time, and Type) is a very effective basic framework in designing training programs to increase athletes' leg power. Frequency refers to how often exercises are performed in one week. For leg power development, explosive exercises such as plyometric or squat jumps are usually performed 2-3 times per week so that the muscles have sufficient recovery time. Training too often without rest can lead to muscle fatigue, while too infrequent a frequency will hinder strength development (Alves, 2022; Lemos, 2020).

Intensity is the key to training leg muscle power. Exercises with heavy weights, such as weighted squats, or high-speed exercises, such as box jumps, must be performed with sufficient intensity to spur muscle adaptation. Training intensity can be regulated by lifting weight (percentage of maximal capacity), speed of movement, or number of repetitions. For example, plyometric exercises are performed at a high intensity involving maximal explosive jumps in short reps to optimize muscle work without losing efficiency.

Time and Type also play an important role in the FITT principle. The duration of training (time) needs to be adjusted to the type of explosive exercise to avoid excessive fatigue, usually ranging from 30-60 minutes per session. Meanwhile, the type of exercise should focus on movements that predominantly involve the leg muscles. A combination of exercises such as vertical jumps, lunges, and other explosive exercises can improve both leg strength and coordination. By consistently applying the FITT principles, athletes are not only able to increase leg power, but also minimize the risk of injury and maintain performance at the highest level.

Knee tuck jump is one of the plyometric exercises that has proven to be very effective in increasing leg muscle power, especially for volleyball athletes. Research shows that this exercise helps increase explosive power through fast-twitch muscle contraction, which is important for jumping higher and moving faster. For example, one study showed a significant increase in vertical jump height after the implementation of a plyometric training program, including the knee tuck jump, with results showing an average increase of 6.2 cm in the experimental group compared to the control group (Myer et al., 2008).

In addition to increasing leg muscle power, the knee tuck jump also supports neuromuscular control. This exercise encourages the body to learn to maintain balance and stability while performing explosive movements, which is beneficial for preventing injuries, especially to the knee area (Tomes, 2020). Another study noted that this exercise helps reduce the risk of anterior cruciate ligament (ACL) injury by improving biomechanical control during landing.

The effectiveness of the knee tuck jump is also seen in various sports, including volleyball, where players require high jumping ability to perform spikes and blocks. This exercise not only improves leg muscle strength but also helps athletes achieve efficiency in energy transfer during jumping. By integrating this exercise on a regular basis, athletes can see significant improvements in their performance and explosiveness, which supports a competitive edge on the field.

CONCLUSION

Based on hypothesis testing that the FITT principle with the knee tuck jump training method has an effect on the results of volleyball athletes' leg power. The increase in pretest to posttest from 93.10 to 99.00 or an increase of 6.34%. This shows that the FITT principle of knee tuck jump training is effective for increasing athlete leg power.

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