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The practice method increases the strength and power of female professional athletes

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Abstract

Well-planned and structured physical training is essential for enhancing athletic performance, particularly in sports like beach volleyball that demand strength and power. This research aims to assess the effects of practice methods on the strength and power of female athletes in the Indonesian National Beach Volleyball Team. This research employs an experimental method with a pre-test and post-test design. This study used a total sampling technique to obtain 6 female athletes from the Indonesian National Beach Volleyball Team with an age range of 19-27 years. The practice method is the OPT (Optimum Performance Training) method. This research was carried out for 12 weeks with a training frequency of 3 times a week. Strength was evaluated using the 1 RM test, and power was measured with the RAST test. Analysis of this research data using SPSS 22 includes the normality test and the independent t_{test}. The independent T-test results indicated that the Sig value for strenght 0.01 and power 0.00 was less than 0.05, demonstrating a significant difference between the pre-test and post-test. The research concludes that a 12-week OPT training program significantly enhances the strength and power of female athletes on the Indonesian National Beach Volleyball Team. Based on the results of this study, the contribution that can be given to coaches is that they can apply OPT to increase the strength and power of athletes in beach volleyball and other sports.

Keywords: OPT (Optimum Performance Training), strength, power, female athletes, volleyball.

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INTRODUCTION

Sports play a crucial role in enhancing a country's reputation (Pratiwi et al., 2018). Athletes who have undergone training are expected to continually improve their performance (Hidayah et al., 2024; Pembayun et al., 2018). Athletes with good physical condition generally deliver better performances (Pratiwi et al., 2018). Women's beach volleyball is the fastest-growing sport, so it requires good training and performance characteristics to support it (Bozzini et al., 2021). This is especially true for volleyball players, who are expected to demonstrate strong lower body strength and power to support their performance (Guthrie et al., 2021). Strength and power are vital for beach volleyball athletes, as the sport involves explosive actions such as high leaps and strong hits, depending on maximum explosive power (Kitamura et al., 2020). Having sufficient physical strength also helps athletes sustain endurance and adjust to tough conditions, like sand that restricts movement, which are crucial for optimal performance in every game (Suhadi et al., 2023).

Over the past two decades, muscle strength and power have garnered significant attention (Arntz et al., 2023; Hafidz et al., 2022). Strength and power are fundamental physical aspects that athletes must possess (Włodarczyk et al., 2021). Women are also known to be less powerful than their male counterparts (Bartolomei et al., 2021). Therefore, the strength and power of female athletes require special attention and tailored training approaches. Strength and power training for women, particularly volleyball players, typically involves a combination of weight training and plyometrics (Maćkała et al., 2021). Exercises like squats, deadlifts, and shoulder presses focus on building muscle strength in key areas such as the legs, shoulders, and core. In contrast, plyometric exercises like box jumps, jump squats, and medicine ball slams are intended to boost explosive power. This blend of training enhances jumping ability, reaction speed, and hitting power, all of which are crucial in volleyball (Kitamura et al., 2020; Riliana Abanat et al., 2021).

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There is a lot of research on increasing strength and power with plyometric training models, HIIT (Pratiwi et al., 2018), weight lifting, eccentric training, and ballistic training (Włodarczyk et al., 2021). Plyometric training increases strength (Pratiwi et al., 2018) and power (Maćkała et al., 2021). HIIT workouts increase power (Fajrin et al., 2018). However, a literature review by researchers indicates that while the Optimum Performance Training (OPT) method is widely applied, it has not been extensively researched. Therefore, the novelty of this research lies in its focus on the Optimum Performance Training (OPT) model. OPT is a systematic training approach designed to improve athletic performance by using a progressive system (Novia Eka Putri et al., 2024). Developed by NASM, it focuses on five main stages: stability, power, hypertrophy, endurance, and strength. Every stage is created to focus on certain aspects of physical ability, like core stability, functional strength, explosive power, and muscle growth. The OPT program combines different types of training, like strength training, plyometrics, and cardiovascular exercises, to develop a personalized routine that fits the athlete's specific requirements. By tailoring the program to the athlete's fitness level and goals, this approach can be customized to improve performance in various sports, such as volleyball. OPT uses a structured method to assist athletes in developing a body that is more well-rounded, robust, and able to prevent injuries (Bıyıklı, 2018).

The OPT model focuses on enhancing movement efficiency through multiple training methods aimed at improving neuromuscular stability, functional flexibility, functional strength, core stability, and reactive neuromuscular training. It is divided into five phases: stabilization endurance, strength endurance, hypertrophy, maximal strength, and power (Clark et al., 2012).

The capacity to generate high forces, such as strength and power outputs, is crucial for overall athletic performance and is considered fundamental for athlete development. Supporting this, studies have shown that relative strength and power are greater in faster athletes, indicating they

may predict superior performance (Cormier et al., 2020). Strength and power significantly influence sports performance (Ličen & Kozinc, 2023). While the idea of establishing a strength foundation before developing power is widely accepted among coaches and sports scientists, empirical evidence for this approach remains inconclusive. This indicates that strength and power are key physical attributes for athletes (Loturco et al., 2013). Women's beach volleyball is the fastest-growing sport, so it requires good training and performance characteristics to support it (Bozzini et al., 2021). Volleyball performance involves a range of physical, technical, and tactical abilities that are crucial for success in the sport (Guo & Wang, 2024). It is shaped by several factors, including strength, agility, endurance, and specific technical skills such as serving, spiking, blocking, and setting. Strength and power are particularly important for actions like jumping and hitting, which are key to both offense and defense. Volleyball players benefit from a thorough training program that incorporates plyometrics, strength conditioning, and sport-specific routines to enhance performance and lower the chance of injury (Jariono et al., 2024; Keoliya et al., 2024). The neuromuscular system's ability to produce force is vital for sports performance, particularly in activities that involve changes in direction, sprinting, jumping, and throwing. Specifically, volleyball skills such as serving, attacking, blocking, setting, digging, and receiving serves require a high level of functional ability (Kitamura et al., 2020).

Power, often referred to as explosive power (Darusman et al., 2022), is a critical movement ability that supports performance in all sports (Nugroho et al., 2021). Leg muscle power is the capability of the leg muscles to perform activities quickly and forcefully to generate power (Darusman et al., 2022). In jumping, leg muscle strength is essential because it acts as the fulcrum and supports the impulse to lift the entire body into the air (Pembayun et al., 2018). Volleyball performance can be compromised by injuries, fatigue, and inconsistent technical skills, which hinder players' ability to execute essential movements and strategies effectively. Moreover, mental factors like anxiety and ineffective team interactions can interfere

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with communication and unity on the court, resulting in decreased performance in crucial game moments (Kitamura et al., 2020).

Previous studies on volleyball athletes have demonstrated that a 6-week regimen of plyometric front cone hop and plyometric counter-movement jump training is highly effective for improving leg muscle strength and power (Pratiwi et al., 2018). Additionally, jump-to-box, depth jump, and single-leg depth jump exercises over 18 weeks significantly enhance leg muscle strength and power (Pembayun et al., 2018). High-intensity interval training (HIIT) has also been shown to boost the strength and power of the lower limbs (Caparrós-Manosalva et al., 2023), while a 12-week resistance training program increases both strength and power (Blocquiaux et al., 2020). The difference from previous research is in the training method, the previous research used the resistance method and this research used the OPT method. Given the importance of leg muscle strength and power in volleyball (Pratiwi et al., 2018). The impact of the Optimum Performance Training (OPT) model on these attributes in volleyball athletes remains unexplored. This research aims to evaluate the effect of a 12-week OPT training program on the strength and power of volleyball athletes.

METHOD

This research employs an experimental method with a pre-test and post-test design to investigate the impact of Optimum Performance Training (OPT) on strength and power. The study's population consisted of six female athletes from the Indonesian National Beach Volleyball Team. The researchers employed a total sampling method, selecting all six female athletes from the Indonesian National Beach Volleyball Team. So, the total sample in this study was 6 athletes. The test utilized in this research is specifically created to evaluate power and strength. This assessment specifically evaluates the participants' capacity in these two physical characteristics. The strength measurement instrument used 1 RM test for lower body squat Guthrie et al., (2021); Kitamura et al. (2020), and power used RAST Test was measured with the RAST test (Jatmiko et al., 2024).

The Optimal Performance Training (OPT) program is conducted over 12 weeks Blocquiaux et al. (2020), comprising a total of 36 sessions, with a training frequency of 3 times a week (Hariyanto et al., 2020). Data analysis was performed using SPSS 21 software, employing a T-test with a significance level of α = 0.05. Based on the measurement results obtained, they will be made in Excel format so that statistical analysis can be continued.

The Optimum Performance Training (OPT) Model Procedure

The Optimal Performance Training (OPT) program is conducted over 12 weeks (Blocquiaux et al., 2020), comprising a total of 36 sessions, with a training frequency of 3 times a week (Hariyanto et al., 2020), with this program, athlete performance can be improved (Kapsis et al., 2022). The OPT (Optimum Performance Training) method includes five distinct phases. These phases are designed to progressively enhance different aspects of an athlete's physical capabilities, culminating in increased strength and power (Clark et al., 2012). Below, we will explain the 5 phases of OPT:

1. Stabilization Endurance: This phase focuses on improving muscle stability and endurance.
2. Strength Endurance: In this phase, athletes enhance muscle strength and endurance. The number of repetitions remains the same as in the stabilization endurance phase, but the intensity increases by 40%-50% of 1RM, requiring more energy.
3. Hypertrophy: This phase involves high-intensity training with a volume of 75%-85% of the one-repetition maximum (1RM), with 6-12 repetitions per set.
4. Maximal Strength: Training in this phase uses very heavy loads, 85%-100% of 1RM, with low repetitions (1-5 repetitions per set).
5. Power: This phase consists of exercises like Superset Squats combined with Box Jumps. Heavy squats are performed in 3-5 sets of 1-5 repetitions, followed by Box Jumps for 3-5 sets of 8-10 repetitions.

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RESULT

The results will present data on the characteristics of the research sample, normality test, and T-test.

Table 1. Characteristics of the research sample

No.	Initials	Body Weight (Kg)	Height (Cm)	BMI (kg.m-^{2})
1	DR	64	169	22.4
2	NAS	52	168	18.4
3	SH	56	170	19.4
4	DM	56	170	19.4
5	JS	77	177	24.6
6	FU	66	180	20.4
Mean		61.83	172.33	20.76
Standard Deviation		8.33	4.50	2.11

Table 1 shows the characteristics of 6 athletes. The mean age of athletes is 23.17 years, the mean weight of athletes is 61.83 kg, the height of athletes is 172.33 cm, and the mean BMI of athletes is 20.76 kg.m-^{2}.

Table 2. Pretest and posttest data

	Mean	N	Std. Deviation	Std. Error Mean
Post Power	249,7167	6	46,19495	18,85901
Pre Power	243,0667	6	45,41914	18,54229
Post Strength	155,6667	6	22,16002	9,04679
Pre Strenght	151,6667	6	22,81812	9,31546

Based on the statistical results in the table above, the power and strength variables in the post-test are higher than in the pre-test.

Table 3. Paired Sample Test

Variable	Mean	Std. Deviation	Std. Error Mean	Sig. (2-tailed)
Strenght Pre Test-Post Test	4,00000	1,26491	,51640	0,01
Power Pre Test-Post Test	6,65000	1,68493	,68787	0,00

The results of the Paired Sample Test in Table 3 show that the Sig value is 0,01 for strength and 0,00 for power < 0.05, indicating that there is a significant influence of the OPT method on strength and power in female athletes.

DISCUSSION

The research results show that the OPT (Optimum Performance Training) model for 12 weeks increased strength and power in female athletes from the Indonesian National Beach Volleyball Team. The results of this study are supported by previous research that OPT-EMS training has statistically significant differences in push-up, squat, crunch, plank, and Max Vo2 performance (Bıyıklı, 2018). Other research with other training

methods, namely High-intensity interval training (HIIT), has also been shown to increase the strength and power of the lower limbs (Caparrós-Manosalva et al., 2023). Apart from that, previous research also found that the 12-week resistance training program increased both strength and power (Blocquiaux et al., 2020).

The findings of this study suggest that the OPT method's incorporation of strength and power components makes it suitable for enhancing athletes' strength and power. According to existing literature, training programs focusing on strength and power have proven effective in enhancing athletic capabilities among team sports players. These positive adaptations may involve changes in physiological mechanisms, such as the storage and utilization of elastic energy or the function of the stretch-shortening cycle, as well as morphological factors like muscle architecture or fiber type, and neural factors, including motor unit recruitment, synchronization, firing frequency, and intermuscular coordination. Additionally, the increased rate of force development (RFD), which refers to the maximal rate of rise in muscle force during the initial phase of contraction, is another critical factor that contributes to improvements in athletic performance, particularly in team sports (Cormier et al., 2020).

Strength is foundational to other biomotor components and must be prioritized for improvement (Junaydullaevich & Khizi, 2023; Karavirta et al., 2011). This is crucial because strength plays a critical role in all physical activities, aiding athletes in injury prevention. Muscle strength is defined as the maximum force or torque a muscle can generate against resistance during various sports activities like volleyball (Anam et al., 2022). In volleyball, limb power biomotor components are essential for jumping, both for attacking (smashing) and defending (blocking). Athletes lacking limb power may struggle to execute explosive movements quickly. Power is crucial in volleyball as it supports various techniques such as serving and smashing, contributing significantly to a player's skill set (Novita et al., 2022). Having power or explosive strength is crucial in volleyball since it impacts the player's overall performance. Having strong explosiveness

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enables athletes to execute quick and forceful moves like spikes, enhancing their opportunities to score points (Putra et al., 2024; Riliana Abanat et al., 2021).

Furthermore, having power allows for better jumping, attacking at optimal heights, and blocking effectively. This skill also boosts physical stamina, enabling players to sustain top-level play during the game, especially in challenging conditions. Hence, it is crucial to enhance a volleyball team's performance by building strength through effective training (Jastrzebski et al., 2014; Novita et al., 2022).

Measuring strength and power is very important in the sport of volleyball (Zemková, 2022). Therefore, assessments and exercises aimed at enhancing strength and power are crucial. The strength of leg muscles significantly influences the outcome of a smashing jump due to its power and speed. Strong leg muscles are pivotal in volleyball as they drive physical movements during gameplay (Riliana Abanat et al., 2021). Repetitive movements lead to muscle contractions that enhance muscle size and cell dimensions through increased training between sets and the number of muscle fibers. This adaptation improves muscle power by enabling rapid contractions, enhancing lower limb power (Darusman et al., 2022).

This study aimed to assess the effectiveness of a 12-week Optimum Performance Training (OPT) program in enhancing the strength and power of female athletes from the Indonesian National Beach Volleyball Team. The results indicated that the OPT method significantly improved these physical attributes, contributing to better on-court performance. However, certain limitations must be acknowledged. One is the relatively small sample size, which may limit the generalizability of the findings to a wider population. Additionally, the study exclusively targeted female volleyball players, meaning the outcomes may not apply to male athletes or those in other sports. Environmental factors, such as access to training facilities and equipment, may have also influenced the results.

Furthermore, the study did not explore the long-term effects of the OPT method, leaving questions about its benefits beyond the 12-week

duration. Despite these limitations, the research successfully demonstrated that the OPT method is an effective strategy for enhancing strength and power in female volleyball players. Future studies should consider more significant, more diverse populations and examine the long-term impact of this training method across different sports.

By employing a structured approach, the OPT method aims to enhance athletes' physical performance through training that emphasizes the development of functional abilities, including muscle strength and power. These findings suggest that a targeted training program like OPT not only enhances individual performance but also has the potential to offer teams a competitive edge when facing opponents in matches.

CONCLUSION

Based on this research, the OPT model over 12 weeks effectively enhances strength and power among female athletes from the Indonesian National Beach Volleyball Team. The limitation of this study is that it was only conducted on female athletes. The implication is that it needs to be conducted on male athletes. Future research should consider applying the OPT model to different sports and comprehensively assessing all parameters of athletes' physical conditions post-implementation of OPT. Based on the results of this study, the contribution that can be given to coaches is that they can apply OPT to increase the strength and power of athletes in beach volleyball and other sports.

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