



The Effect of Functional Training on Leg Muscle Power for Block Jumps in Volleyball

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Abstract

Improving leg muscle power is essential to support explosive movements in volleyball, particularly for defensive actions such as block jumps. Therefore, a specific and functional training approach is needed to enhance athletes' lower limb explosive power and optimize blocking performance. This study aims to determine the effect of functional training on leg muscle power for block jumps in volleyball athletes at Tribakti Pangalengan Vocational High School, considering that many adolescent volleyball athletes still experience limitations in vertical jump performance, which affects the effectiveness of blocking techniques during matches. The method used was a pre-experimental One Group Pretest–Posttest with a sample of 15 athletes aged 15–18 years who were selected purposively. The treatment was a functional training program including box jumps, squat jumps, lateral bounds, and Bulgarian split squat jumps carried out for 12 meetings (3 times/week). The instrument for measuring leg muscle power used the Vertical Jump Test with pretest and posttest procedures. The results of the descriptive analysis showed an average increase in vertical jump from 47 cm (pretest) to 53 cm (posttest), with an average difference of 6 cm. The Shapiro–Wilk normality test showed that the data were normally distributed, so the Paired Sample t-Test test was continued which resulted in $t = -17.64$ and $p = 0.000$ ($p < 0.05$), which means the increase was statistically significant. These findings are consistent with the literature stating that functional training is effective in increasing explosive strength and movement quality. In conclusion, functional training significantly improves leg muscle power, which supports block jumping ability in volleyball athletes.

How to Cite

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INTRODUCTION

Sports play a strategic role not only in improving physical fitness but also as a means of character development and achievement through a focused and systematic training process (Fahrizqi, 2021). One rapidly growing and popular sport is volleyball, which demands a combination of technical skills, physical fitness, and tactical intelligence to navigate the dynamics of the game (Supriatna, 2024). In this context, an athlete's successful performance is heavily influenced by mastery of basic techniques supported by optimal physical abilities.

One of the most important techniques in volleyball is blocking, which serves as the primary defense against opponent attacks, particularly smashes. Blocking not only helps block attacks but can also provide an opportunity to score points if executed effectively (Pardiman, 2021). The success of a block is largely determined by the athlete's vertical jump height, which is closely related to leg muscle power (Anggraeni, 2022).

PowerLeg muscle power is the ability of muscles to generate explosive force in a short period of time, which is a key factor in supporting vertical jump performance (Susila, 2021). This ability is a combination of strength and speed of muscle contraction, which plays a direct role in increasing jump height and the effectiveness of explosive movements in the game (Darusman, 2022). Therefore, increasing leg muscle power is a crucial aspect of a volleyball athlete's training program, particularly in supporting optimal blocking ability.

One training method considered effective in increasing leg muscle power is functional training. This method emphasizes functional movement-based exercises that mimic actual sports activities, thereby improving overall movement quality, including strength, balance, coordination, and body stability (Hary & Pratama, 2023). Furthermore, functional training also plays a role in optimizing fundamental movement patterns and reducing the risk of injury by improving neuromuscular control (Kovac, 2021).

Various previous studies have shown that functional training is effective in improving muscle strength, jumping ability, and movement quality in athletes. Hary and Pratama (2023) found that functional training significantly improved leg muscle strength and balance, while (Wang, 2024) demonstrated that this method significantly improved jumping ability and movement stability in athletes. However, these

studies tended to focus on improving general physical abilities or other sports, so they have not specifically examined the direct relationship between functional training and improved block jumping ability in volleyball.

Based on field observations, volleyball athletes from Tribakti Pangalengan Vocational High School still experience difficulties in blocking effectively, as evidenced by their low vertical jump ability, which makes them less than optimal in blocking attacks. This situation indicates the need for a more specific and targeted training program to improve leg muscle power in the context of blocking skills.

The novelty of this research lies in its focus on specifically analyzing the effect of functional training on increasing leg muscle power, directly integrated with block jump ability in volleyball in adolescent athletes at the Vocational High School level. Furthermore, this study uses a combination of functional training forms such as box jumps, squat jumps, lateral bounds, and Bulgarian split squat jumps, which are specifically designed to support the explosive movement needs in blocking techniques, thus providing a more applicable and contextual training approach compared to previous studies that tend to be general in nature.

Based on this description, this study aims to analyze the effect of functional training on increasing leg muscle power to support block jump ability in volleyball athletes. This research is expected to provide scientific contributions to the development of performance-based training methods and serve as a practical reference for coaches in developing effective and applicable training programs.

METHOD

This study used an experimental method with a pre-experimental design approach, namely a one-group pretest-posttest design. This design was used to determine the effect of a functional training program on increasing leg muscle power by comparing the results before (pretest) and after (posttest) the treatment (Sugiyono, 2020).

The subjects were 15 male volleyball athletes from Tribakti Pangalengan Vocational High School, aged 15–18 years, who also constituted the population in this study, who also constituted the population. The sampling technique used total sampling, thus the entire population was used as the research sample.

The instrument used in this study was the vertical jump test, the primary tool for measuring leg muscle power. Measurements were taken two-

ce: before treatment (pretest) to determine initial ability, and after treatment (posttest) to determine improvements following the training program.

The treatment in this study was a functional training program consisting of several exercises, namely box jumps, squat jumps, lateral bounds, and Bulgarian split squat jumps. The training program was carried out over 12 sessions, three times a week.

The data analysis techniques used included descriptive statistical analysis and inferential testing. Normality testing was performed using the Shapiro–Wilk test, while hypothesis testing used a paired sample t-test with a significance level of 0.05 (Fadluloh et al., 2024).

RESULTS AND DISCUSSION

Table 1. Descriptive Test

Statistics	Pretest	Posttest
Number of Samples (N)	15	15
Minimum Value	34	41
Maximum Value	74	84
Mean (Average)	47.13	53.53
Standard Deviation	9,760	10,412

The descriptive analysis results show that the sample size used was 15 students with pretest scores ranging from 34 to 74 and an average score of 47.13. After being given treatment, posttest scores increased with a range of scores from 41 to 84 and an average increase of 53.53. This increase illustrates that students' overall abilities improved after the intervention was given. In addition, the standard deviation in the pretest was 9.760 and in the posttest was 10.412, indicating that the variation in students' scores was relatively stable although slightly more spread out in the posttest. In general, this descriptive data confirms a trend of increasing student abilities from before to after treatment.

Table 2. Normality Test

Variables	Shapiro-Wilk Statistics	df	Sig.
Pretest	0.892	15	0.071
Posttest	0.939	15	0.369

Based on the results of the normality test using Shapiro–Wilk, the pretest Sig. value was 0.071 and the posttest Sig. value was 0.369. Since both Sig. values were greater than 0.05, the null hypothesis (H_0) which states that the data is normally distributed is accepted. Thus, the pretest and posttest data have a normal distribution, so that further hypothesis testing can be carried out

using a parametric test, namely the Paired Sample t-Test, to determine the effect of functional training on increasing the athlete's leg muscle power.

Table 3. Hypothesis test

Paired Differences	Mean	Standard Deviation	t	df	Sig. (2-tailed)
Pretest – Posttest	-7.3	1.65	-17.64	14	0,000

Based on the results of the Paired Sample t-Test, the t-value was -17.64 with a significance value of 0.000, which is less than 0.05. This indicates that there is a significant difference between the pretest and posttest scores, so the null hypothesis (H_0) is rejected and the alternative hypothesis (H_1) was accepted. In other words, functional training significantly increased leg muscle power in volleyball athletes at Tribakti Pangalengan Vocational High School. These results reinforce the finding that this training is effective in increasing leg muscle strength and explosive power, which are important for explosive movements such as block jumps and smashes.

Based on the results of data analysis, it was found that all athletes experienced an increase in vertical jump values after being given functional training treatment. The average pretest result of 47.13 cm increased to 53.53 cm in the posttest, with an average difference of 7.3 cm or approximately 13.91%. This increase indicates that functional training has a positive impact on the leg muscle power of athletes. This finding is in line with the research objective, namely to determine the effect of functional training on leg muscle power which contributes to increasing block jump ability in volleyball (Hary & Pratama, 2023; Wang et al., 2024).

Descriptively, the athletes' pretest results were in the range of 34–74 cm, with varying categories, ranging from adequate to perfect. After being given functional training, posttest results increased to 41–84 cm, with most athletes experiencing a shift to a higher category, specifically from the fair and good to good and excellent categories. This indicates that the training program provided was able to improve the athletes' physical quality evenly, particularly in terms of leg muscle explosiveness. These findings support the theory that functional movement-based exercises are effective in improving explosive muscle performance and movement quality in athletes (Carr & Feit, 2022; Susila, 2021).

The results of the normality test show that the pretest and posttest data are normally distributed, so the hypothesis test using the Paired

Sample t-Test could be conducted. The results of the paired t-test showed a significance value of 0.000 ($p < 0.05$), which means there is a significant difference between the pretest and posttest results. Thus, the alternative hypothesis (H_1) is accepted, namely that there is a significant influence of functional training on increasing leg muscle power in volleyball athletes from Tribakti Pangalengan Vocational High School. These findings support the results of descriptive statistics and previous studies stating that functional training can significantly improve lower limb explosive power and athletic performance (Kovac; 2021).

In addition, the results Paired Samples Correlation shows a correlation value of 0.992 with a significance level of 0.000, indicating a very strong relationship between pretest and posttest scores. This indicates that the improvement that occurred was consistent and did not occur randomly, but rather was a direct impact of the treatment. functional training given during the research period.

The results of this study are relevant to the theory put forward by (Carr & Feit, 2022), which states that functional training is a comprehensive training approach that not only improves muscle strength but also movement quality, coordination, stability, and mobility. In the context of volleyball, the need for high and stable jumps when blocking relies heavily on the explosive power of the leg muscles, supported by movement coordination and body stability. Therefore, functional training which involves plyometric, unilateral, and total body strengthening exercises can support optimal improvement of block jumping ability.

This finding also aligns with (Adib & Muhammad, 2019) opinion, which states that jump height is a key factor in successful blocking. The increase in leg muscle power, reflected in the increase in vertical jump scores in this study, indicates that athletes have better explosive abilities, potentially increasing blocking effectiveness in competitions. This is reinforced by (Amalia, 2019) opinion, which asserts that optimal vertical jump ability requires a combination of leg muscle strength and speed.

Apart from supporting the theoretical basis, the results of this study are also consistent with previous research conducted by (Arif & Hartati, 2016), which concluded that functional training had a significant effect on increasing leg muscle strength and balance. The percentage increase in leg muscle power in this study was in the moderate to high category, indicating that functional movement-based training is effective in

adolescent athletes. Similarly, these findings support the results of systematic review Wang (2024) stated that functional training able to significantly increase muscle strength, jumping ability, and the quality of athletes' functional movements. Functional training was shown to significantly improve muscle strength, jumping ability, and athletes' functional movement quality. However, this study was limited by the small sample size, short intervention duration, and absence of a control group. In addition, several athletes showed varying levels of improvement during the treatment, indicating differences in individual adaptation to the training program. Future studies are recommended to use larger samples and longer training periods to obtain more comprehensive results.

CONCLUSION

Based on the findings of this study, functional training can be considered an effective training method for improving leg muscle power in volleyball athletes. The improvement in athletes' explosive power indicates that functional movement-based exercises are able to support physical performance related to blocking techniques in volleyball. Therefore, functional training may be used as an alternative training approach by coaches to optimize athletes' jumping ability and overall volleyball performance, particularly in adolescent athletes.

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