Vol. 6 No. 2, Desember 2025
e-ISSN: 2775-6254
p-ISSN: 2716-1900

SPORT-MU: JURNAL PENDIDIKAN OLAHRAGA
https://ejurnal.unmuhjember.ac.id/index.php/sportmu/index
DOI: 10.32528/sport-mu.v6i2.4715

The Effect of Circuit Bodyweight Training on Underhand Passing Ability in Volleyball Extracurricular Aged 12-14 Years

Pengaruh *Circuit Bodyweight Training* terhadap Kemampuan *Passing* Bawah pada Ekstrakurikuler Bola Voli Usia 12-14 Tahun

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Abstract

Despite the use of various training methods for underhand passing, many young players still exhibit inconsistencies in strength, passing control, and accuracy. Therefore, specific training methods are needed, one of which is bodyweight strength training. The purpose to analyze effect of Circuit Bodyweight Training on underhand passing in students aged 12-14 years in volleyball extracurricular. This research is a quasi-experimental with one group pretest-posttest design. The intervention was carried out for 6 weeks (18 meetings) while the intervention program can be shown in Table 1. The sample consisted of 13 male students and 13 female students. Then, training dose is 3–5 sets, 12–16 repetitions or 30–50 seconds, intensity 70%–85%. The instrument for underhand passing ability used a modified Brady Volleyball Test. The results showed a significant effect after being given the intervention, male students and female students 0.000<0.05. Independent t test showed no difference in the ability of the underhand pass based on the posttest in male students and female students 0.113>0.05. While, coefficient of determination (R Square) showed 45.9% in male students and 38.6% in female students. Conclusion, Circuit Bodyweight Training is an efficient and accessible training method to improve the ability of underhand pass in young volleyball athletes, regardless of gender at the age of 12-14 years. Future research can adopt an experimental design involving a control group, a combination of various training methods.

Keywords: volleyball skills, volleyball training, extracurricular sports, young athletes

Abstrak

Meskipun telah menggunakan berbagai metode latihan untuk passing bawah, banyak pemain muda masih menunjukkan ketidakkonsistenan dalam kekuatan, kontrol passing, dan akurasi. Oleh karena itu, diperlukan metode latihan khusus, salah satunya adalah latihan kekuatan menggunakan berat badan. Tujuan penelitian ini adalah untuk menganalisis efek Latihan Kekuatan Berat Badan Berkelompok pada passing bawah pada siswa berusia 12-14 tahun dalam kegiatan ekstrakurikuler voli. Penelitian ini merupakan penelitian quasi-eksperimental dengan desain satu kelompok pra-tes dan pasca-tes. Intervensi dilakukan selama 6 minggu (18 pertemuan), sementara program intervensi dapat dilihat pada Tabel 1. Sampel terdiri dari 13 siswa laki-laki dan 13 siswa perempuan. Dosis latihan adalah 3–5 set, 12–16 repetisi atau 30–50 detik, dengan intensitas 70%–85%. Alat ukur kemampuan passing bawah menggunakan Brady Volleyball Test yang dimodifikasi. Hasil menunjukkan efek yang signifikan setelah diberikan intervensi, dengan nilai p < 0,05 untuk siswa laki-laki dan perempuan. Uji t independen menunjukkan tidak ada perbedaan dalam kemampuan passing bawah berdasarkan posttest pada siswa laki-laki dan perempuan (p > 0,05). Sementara itu, koefisien determinasi (R Square) menunjukkan 45,9% pada siswa laki-laki dan 38,6% pada siswa perempuan.

Kesimpulan, Latihan Beban Tubuh Sirkuit merupakan metode latihan yang efisien dan mudah diakses untuk meningkatkan kemampuan passing bawah pada atlet voli muda, tanpa memandang jenis kelamin pada usia 12-14 tahun. Penelitian di masa depan dapat mengadopsi desain eksperimental yang melibatkan kelompok kontrol, kombinasi. Kesimpulan, Latihan Beban Tubuh Sirkuit merupakan metode latihan yang efisien dan mudah diakses untuk meningkatkan kemampuan passing bawah pada atlet voli muda, tanpa memandang jenis kelamin, pada usia 12-14 tahun. Penelitian di masa depan dapat mengadopsi desain eksperimental yang melibatkan kelompok kontrol, serta kombinasi berbagai metode latihan.

Kata kunci: keterampilan voli, latihan voli, olahraga ekstrakurikuler, atlet muda

INTRODUCTION

The ability to pass underhand is one of the fundamental and essential skills in volleyball. This skill not only serves as the first step in receiving an opponent's serve or attack, but also serves as the main foundation for building an effective attack (Hikmawati et al., 2023). An accurate and controlled underhand pass is crucial in directing the ball to the setter with good quality, thus enabling the setter to make an optimal pass to the smasher (Permana & Suharjana, 2013). Without solid underhand passing skills, teams will struggle to sustain rallies, initiate attacks, and ultimately win points (Trimizi et al., 2020). Therefore, perfect mastery of the underhand pass is an important indicator of the success of a player and also a team in volleyball.

Developing underhand passing skills ideally begins at an early age, particularly between the ages of 12 and 14. This age period is known as a critical phase in children's motor development, where they have the optimal capacity to learn and internalize new movement patterns (Syahriadi et al., 2024), (Putro et al., 2025). Establishing a strong foundation of underhand passing at this age will allow students to develop proper technique from the start, avoiding the formation of bad habits that are difficult to break later in life (Kresnapati, 2020). Additionally, by intensively practicing underhand passing at this age, students will build confidence, improve their tactical understanding of the game, and significantly increase their potential to become skilled and competitive volleyball players in the future (Putra et al., 2024).

Previous studies have examined various training models to improve underhand passing ability in volleyball. Some studies have focused on explosive strength training, such as plyometrics, to increase leg muscle power, which impacts jump height and body position during passing (Silva et al., 2019). Other research explored agility and reaction

DOI: 10.32528/sport-mu.v6i2.4715

speed training to improve players' ability to reach the ball quickly (Budi, 2021). There are also studies that examine the effectiveness of specific underhand passing drill training with variations in intensity and repetition (Azizi et al., 2022). Although various exercise models have been studied, there is still a need to identify exercise methods that are not only effective but also efficient, easily adapted, and suitable for young age groups with limited facilities.

Based on the description above, the research problem focuses on the suboptimal underhand passing ability of students aged 12-14 years in volleyball extracurricular activities. Although the importance of underhand passing has been understood and various training exercises have been implemented, many students still show inconsistencies in the accuracy, power, and control of their passes. This indicates that existing training methods may not be fully effective in developing the necessary physical and technical components comprehensively, or that there is a lack of structured and scientifically proven training programs to improve this skill in this specific age group.

This study chose to use the Circuit Bodyweight Training method as an exercise intervention. This approach was chosen for several fundamental reasons. First, Circuit Bodyweight Training is a very practical and economical method, requiring no expensive specialized equipment, making it highly suitable for implementation in school or extracurricular environments with limited resources (Fadhila et al., 2024). Second, this exercise inherently engages multiple muscle groups in a functional and integrated manner, which is highly relevant for building functional strength, muscular endurance, and whole-body coordination, which are essential prerequisites for effective underhand passing (Zanada et al., 2023).

The purpose of this study is to analyze and empirically prove the effect of Circuit Bodyweight Training on the underhand passing ability of students aged 12-14 years in extracurricular volleyball. The novelty of this study lies in the specific exploration of Circuit Bodyweight Training as a training method that has been proven effective and practical to improve underhand passing ability in the age group that is in a crucial phase of motor development, namely 12-14 years. This research is expected to make a significant contribution to the development of volleyball training curriculum at the

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beginner level, as well as presenting an alternative, innovative and affordable training solution for coaches and instructors.

METHOD

Research Procedures

This study was a quasi-experimental study with a one-group pretest-posttest design, so it did not involve a control group. The study consisted of three stages: the first was a pretest, the second was a six-week intervention, and the third was a posttest. Data collection for the low-passing ability variable used the Brady Volleyball Test, modified to meet the needs of the participants. (Permana et al., 2025).

The intervention program in circuit bodyweight training adopts the results of previous research. (Fadhila et al., 2024), The following is the intervention program in table 1

Table 1. Intervention Program

Pos	Type of Exercise	Target of Exercise
1	Shoulder Tapping Push Up	Chest
2	Inchworm to Side Plank	Core
3	Reclining Circle	Stomach
4	Reclining Triceps Press	Arms
5	Lateral Plyo Squat	Limbs
6	Slide Out	Back
7	Floor Inverted Shoulder Press	Shoulders
8	Plank with Leg Lift	Core
9	Reverse Crunch	Stomach
10	Single-Leg Dip	Shoulders
11	Split Jacks	Limbs
12	Back Extension with Opposite Arm and Leg Reach	Back

The training dosage for weeks 1–2 was 3 sets of 12 repetitions, or 30 seconds; for weeks 3–4, 4 sets of 14 repetitions, or 40 seconds; for weeks 5–6, 5 sets of 16 repetitions, or 50 seconds. Recovery between sets was 60 seconds and recovery between sets was 180 seconds, for each intervention program. The intensity of the program was 70%–85%, and intensity monitoring was performed using exercise heart

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rate. The program was implemented in the afternoon during extracurricular volleyball sessions, starting at 3:30 p.m. on Mondays, Wednesdays, and Fridays.

Population and Sample

The study population was SMPN 1 Pangkalan, Karawang, Jawa Barat. The sample consisted of students participating in volleyball extracurricular activities, recruited using total sampling. The sample consisted of 26 students, 13 male and 13 female, aged 12–14 years.

Data analysis

The data analysis in this study used a t-test to examine the effect after the intervention program was administered. Then, an independent t-test was used to examine the differences in post-test results between male and female students. Furthermore, the coefficient of determination was used to determine the strength of the intervention program's effect on underhand passing ability. (R Square). This research data analysis software uses SPSS 27 (George & Mallery, 2021).

RESULTS AND DISCUSSIOON

Results

The first step in reporting the results of this study was to conduct normality and homogeneity tests before conducting the t-test and independent t-test. The normality test in this study refers to the Shapiro-Wilk results because the sample size is less than 30 with a significance level of >0.05.

Table 2. Results of normality test

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Male Pretest	0,165	13	.200	0,971	13	0,304
Male Posttest	0,163	13	.200	0,943	13	0,491
Female Pretest	0,209	13	0,123	0,954	13	0,353
Female Posttest	0,127	13	.200	0,978	13	0,166

Based on the results of Table 2, the significance values for the pretest and posttest for both male and female students were greater than 0.05, indicating a normal

DOI: 10.32528/sport-mu.v6i2.4715

distribution. The homogeneity test for this research data was performed using Levene's test with a significance level of >0.05.

Table 1. Homogeneity test results

		Levene Statistic	df1	df2	Sig.
Underhand Passing Test	Based on Mean	1,151	1	50	0,289
	Based on Median	0,760	1	50	0,387

Based on the results in Table 3, the significance value shown based on the mean shows sig. 0.289 > 0.05, indicating that the research data comes from the same or homogeneous population. After the research data shows a normal and homogeneous distribution, the t-test and independent t-test can be used.

A t-test was conducted to examine the effect of circuit bodyweight training based on a pretest-posttest comparison on low-passing ability. The significance value for decision-making was p<0.05. The t-test results are presented in Table 4.

Table 2. Results of the pretest-posttest difference test

	Mean	Std. Deviation	Std. Error Mean	t	df	Sig. (2-tailed)
Male Pretest-Male Postest	9,615	3,015	0,836	11,499	12	0,000
Female Pretest-Female Posttest	8,615	2,399	0,665	12,947	12	0,000

Based on result 4, the significance value shown by the pretest-posttest for male students was 0.000<0.05 (t = 11.499) then the significance value shown by the pretest-posttest for female students was 0.000<0.05 (t = 12.947). Therefore, there is a significant influence of the circuit bodyweight training program on passing ability in volleyball.

Then, an independent t-test was conducted to determine whether there was a difference in the average scores between male and female students after the intervention. The results of the independent t-test are shown in Table 5.

Table 3. Independent t test results

		t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Underhand Passing Ability	Equal variances assumed	1,358	24	0,113	1,538	0,728
	Equal variances not assumed	1,358	23,810	0,113	1,538	0,728

DOI: 10.32528/sport-mu.v6i2.4715

Based on the results of table 5, the significance value of the lower passing ability between male and female students shows 0.113>0.05, so there is no difference in the average passing ability after being given the intervention program.

In addition, researchers also reported the effectiveness of the intervention program in improving underhand passing ability through the coefficient of determination, or R-square. The following is the R-square for male and female students.

Table 4. R Square Results

	R	R Square	Adjusted R Square
Group of male students	.678	0,459	0,424
Female student group	.622	0,386	0,353

Based on the results of table 6, the R Square value for the circuit bodyweight training intervention program for male students shows an R Square of 0.459 or the effect of the circuit bodyweight training intervention shows 45.9% in male students. Meanwhile, the R Square value for the circuit bodyweight training intervention program for female students shows an R Square of 0.386 or the effect of the circuit bodyweight training intervention shows 38.6% in female students.

Discussion

The findings of this study indicate a positive and significant effect of the Circuit Bodyweight Training program on improving underhand passing ability in students aged 12-14. Several previous studies have shown that circuit training programs significantly impact physical fitness levels in volleyball athletes (Zanada et al., 2023). Although the focus is on general fitness rather than specific skills, circuit training significantly improves speed, muscular endurance, flexibility, agility, explosive strength, vital capacity, and anaerobic capacity in adult male volleyball players (Anitha et al., 2018). These components, such as muscular endurance, strength, and agility, are essential foundations for effective underhand passing.

Furthermore, the effect of circuit training was also found on leg muscle endurance in female volleyball athletes (Irfan et al., 2023). Leg muscle endurance is crucial for maintaining a ready position and performing repeated underhand passes with consistent technique. The study found that circuit training had a significant positive effect on leg muscle endurance, a finding that directly supports the study's ability to

DOI: 10.32528/sport-mu.v6i2.4715

improve underhand passing ability. Furthermore, circuit weight training can be used to increase strength in volleyball players (Hartati et al., 2020), which is a vital physical component for producing the proper thrust when passing.

The bodyweight circuit training applied in this study was designed to develop functional strength, muscular endurance, coordination, and balance using one's own body weight. This exercise directly trains the key muscles involved in underhand passing, such as the leg muscles (for squatting and pushing), the core muscles (for stability and energy transfer), and neuromuscular coordination for smooth, controlled movements. This mechanism aligns with previous findings, which demonstrate the importance of core strength training for volleyball players, contributing to body stability, explosive power, speed, and balance (Bora & Dağlıoğlu, 2022), (Wang et al., 2023). This contribution is an important element in the performance of the underhand pass.

Unlike studies that focus on general fitness, this study directly examines the effect of Circuit Bodyweight Training on the specific skill of underhand passing. Previous research on underhand passing skills of extracurricular volleyball students at SMP N 1 Koto Baru found that students' underhand passing abilities were generally categorized as "adequate," indicating room for improvement (Kuncoro, 2021). This justifies the need for effective training interventions. Furthermore, underhand passing exercises using a school wall can significantly improve junior high school students' underhand passing abilities (Putra et al., 2024). Thus, Circuit Bodyweight Training offers a more comprehensive approach than single drills, as it trains multiple physical components simultaneously, building a stronger foundation for passing skills. Furthermore, a systematic review identified various training techniques, including strength training and core training, that are effective in improving the physical condition of volleyball players (Jariono et al., 2024), which implicitly supports the Circuit Bodyweight Training approach which combines these elements.

The practical implications of these findings are highly relevant for coaches and sports educators. Bodyweight circuit training can be integrated as a core component into volleyball training programs for young athletes, especially in resource-limited settings, as it does not require complex or expensive equipment. By focusing on

DOI: 10.32528/sport-mu.v6i2.4715

developing functional strength, muscular endurance, and coordination, this training will not only optimize passing ability but also build a comprehensive physical fitness foundation, which is essential for overall athletic performance. A uniform training approach for both males and females at this age also supports inclusivity and efficiency in coaching.

However, this study has several limitations. The quasi-experimental one-group pretest-posttest design was applied, without involving a control group. Furthermore, the use of a total sampling method on a limited population in one school (SMPN 1 Pangkalan, Karawang) with a sample of 26 students may limit the generalizability of the findings to a wider student population, and modifications to the Brady Volleyball Test may affect data standardization. Therefore, future research is expected to overcome these limitations by adopting an experimental design involving a control group to compare the effectiveness of Circuit Bodyweight Training with other training methods, or even with a group that does not receive the intervention. Furthermore, expanding the sample with a more heterogeneous scope and longitudinal studies can provide a more comprehensive picture of the long-term effects of this exercise.

CONCLUSION

These conclusions confirm that bodyweight training methods, which develop functional strength, muscular endurance, coordination, and balance, are highly effective for the development of fundamental volleyball skills in young athletes, supporting accuracy, power, and control of underhand passes. The study also found no significant differences in underhand passing ability between male and female students in the 12-14 age group after the intervention. This indicates that at this developmental stage, the capacity to acquire and improve specific motor skills through a structured training program is likely equal for both sexes, supporting inclusive training. R-square analysis showed that Circuit Bodyweight Training substantially explained the variance in improvements in underhand passing ability, amounting to 45.9% in male students and 38.6% in female students. These figures confirm the strong and practical contribution of this training intervention in facilitating performance improvements, with significant

DOI: 10.32528/sport-mu.v6i2.4715

effectiveness for both groups. Overall, this study provides empirical evidence that Circuit Bodyweight Training is an efficient and accessible training method for improving underhand passing ability in young volleyball athletes, regardless of gender, aged 12-14. The practical implication is that coaches can integrate this program as an effective solution for fundamental skill development at the beginner level, optimizing athletes' potential from an early age.

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