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The effect of plyometric training and motivation on the explosive power of leg muscles of extracurricular volleyball students of SMPN 2 Bantan

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Abstract

This study aims to see the difference in the effect of plyometric training and motivation on the explosive power of the limb muscles of volleyball extracurricular students of SMPN 2 Bantan. experimental research design, This type of research is quasi-experimental, the population of this study is all extracurricular volleyball students of SMPN 2 Bantan totaling 60 people, the sample in this study is 32 students, and The sampling technique uses the verdict formula which is 27%. This sampling technique was carried out on a population of 60 people. The instrument used is a leg muscle explosive power test using vertical jump and a Likert scale questionnaire. The data obtained were analyzed with a two-track ANOVA and continued with the Tuckey test. Based on the results of data analysis show that: 1) Overall, there is a difference in the effect between plyometric Quick Leap training and plyometric Depth jump training on the explosive power of leg muscles of volleyball extracurricular students of SMP Negeri 2 Bantan. 2) There is an interaction between the Quick Leap plyometric training approach and the Depth jump plyometric training approach with motivation for the leg muscle explosive power of SMPN 2 Bantan volleyball extracurricular students. 3) In the plyometric Quick Leap exercise, high motivation is better than the Depth jump plyometric training approach to the explosive power of the leg muscles of SMPN 2 Bantan volleyball extracurricular students. 4) In the plyometric exercise, low motivation depth jump is better than the Quick Leap plyometric training approach to the explosive power of the limb muscles of SMPN 2 Bantan volleyball extracurricular students. Based on the results of this study, it can be concluded that plyometric Quick Leap and Depth Jump exercises have different influences on increasing the explosive power of the limb muscles of SMPN 2 Bantan volleyball extracurricular students, especially when considering the level of student motivation.

Keywords: Quick Leap, Depth jump, Motivation, Limb Muscle Explosive Power.

INTRODUCTION

The explosive power of leg muscles is an important component in athletic performance, especially in sports such as volleyball (Indrayana, 2018; Supriyanto, 2018). Strong leg muscles and good explosive power allow athletes to perform fast and powerful movements, such as high jumps to catch or hit the ball (Wulandari et al., 2023). Therefore, the increase in explosive power of the limb muscles becomes the main focus in athletic training. At SMPN 2 Bantan, students involved in extracurricular volleyball have great potential to develop their limb muscle explosive abilities, but the challenge faced is how to train them effectively. This study views that plyometric exercises can be an effective solution, but it is also necessary to consider student motivation factors in undergoing the exercise (Arizal & Lesmana, 2019; M. Putra et al., 2021).

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Plyometric exercises are a training method that has been proven effective in increasing muscle explosive power (Hardovi, 2019). However, in the scientific literature, there have not been many studies that specifically compare the effect of two different types of plyometric exercises, namely Quick Leap and Depth Jump, on the explosive power of volleyball students' leg muscles. The development of knowledge about which types of exercises are more effective can provide valuable insights for trainers and PE teachers in designing more specific and efficient training programs. In addition, motivation is a key factor in the achievement of athletic achievement. Previous research has shown that students who have high levels of motivation tend to achieve better results in training. Therefore, it is important to understand how students' motivation levels can affect the impact of plyometric exercises on the explosive power of their leg muscles, and whether these motivation levels also affect the effectiveness of the two types of plyometric exercises mentioned earlier (Darusman & Putra, 2022).

Sports achievement and the development of young athletes are major concerns in the world of sports (Oktariana & Hardiyono, 2020; Pramono et al., 2023). One crucial aspect of sports performance is the explosive power of leg muscles, which is the ability of muscles to produce explosive power in movements such as jumps and jumps. In various sports, including volleyball, the explosive power of leg muscles has a very important role in achieving optimal performance (Kanbak & Dağlıoğlu, 2020). Therefore, increasing the explosive power of leg muscles has become a major focus in athletic training at various levels, including among high school students. This study aims to understand how plyometric exercises can affect the increase in leg muscle explosive power of volleyball extracurricular students at SMPN 2 Bantan.

The urgency of this research is particularly important in the context of athletic development and education at the secondary school level. The explosive power of leg muscles is a determining factor in the performance of volleyball athletes, and an understanding of how proper plyometric training and motivation can affect their improvement is vital. With the results of this study, sports coaches and educators will be able to design more effective exercise programs, according to the student's individual motivation level, to improve their physical abilities (Osrita et al., 2020). In addition, the study also provides valuable insights into athletic skill development and injury prevention, which are important aspects in improving the quality and sustainability of extracurricular sports programs in schools. Therefore, this research is not only relevant for improving athlete performance but also for supporting students' holistic development in an educational environment.

Plyometric exercises are training approaches that focus on explosive movements such as jumps and jumps (Setyawan & Puspitaningsari, 2017). Various types of plyometric exercises have been used in sports to increase the explosive power of leg muscles, including vertical jumps, horizontal jumps, and jumping exercises from a certain height (Anggoro & Masrun, 2023). Previous research has noted that plyometric exercise can improve jumping ability and produce better explosive power in athletes. However, there is no consensus on the most effective and relevant type of plyometric exercise to increase the explosive power of leg muscles in volleyball extracurricular students at SMPN 2 Bantan.

In addition to physical exercise, motivational factors also have a significant role in the achievement of sports achievements. Highly motivated students tend to be more diligent and disciplined in undergoing their training programs, while low-motivated students may be less motivated to actively participate in exercises and may have difficulty in achieving expected results. Therefore, understanding how students' motivation levels might affect the effectiveness of plyometric exercises in increasing the explosive power of their leg muscles was a very important consideration in this study.

Different Approaches in Plyometric Exercises One of the main aspects that make this study have a strong novelty is the use of two different types of plyometric exercises, namely Quick Leap and Depth Jump, in the context of increasing the explosive power of the limb muscles of SMPN 2 Bantan volleyball students. Most previous studies have focused on only one particular type of plyometric exercise or did not compare two different types of exercise directly. In this study, a direct comparison between the two types of plyometric exercises will provide deeper insight into which one is more effective in increasing the explosive power of leg muscles. The main contribution of this research is to enrich the scientific literature with more specific and useful information for coaches and sports teachers in designing more targeted training programs.

Analysis of the Interaction between Exercise and Motivation This study also considered the motivation factors of students in undergoing plyometric exercises (Çimenli et al., 2016; Shbib et al.,

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2021). Analysis of the interaction between the type of plyometric exercise and the level of motivation of students to the explosive power of their limb muscles is a very new and important aspect. As such, the study fills a knowledge gap in the scientific literature by understanding how students' motivation levels can affect the impact of their plyometric exercises (Padoin et al., 2022). The results of this study will provide valuable guidance for coaches and PE teachers in designing training programs tailored to students' individual motivation levels, which have often been overlooked in the context of sports training (Ramirez-Campillo et al., 2019; Sawant, 2023).

Relevance for Young Athlete Development The purpose of a very sharp evaluation of this study is to improve the performance of young athletes in the field of volleyball, especially students of SMPN 2 Bantan. The main contribution of this study is to provide a better understanding of how to increase the explosive power of the limb muscles of volleyball extracurricular students (Marwat et al., 2023; Sortwell et al., 2021). With a deeper understanding of the effectiveness of plyometric exercises and motivational factors in this context, coaches can develop more effective training programs, which in turn will help produce more competent and accomplished young athletes at the school level as well as in regional competitions (Patir et al., 2021). This study not only focuses on the physical aspect but also recognizes the importance of psychological factors in achieving optimal results in sports (Biswas & Ghosh, 2022).

Previous research has emphasized the importance of plyometric exercises in increasing the explosive power of leg muscles. This method has proven effective in various sports, including volleyball (Sarachandra & Reddy, 2019). Plyometric exercises such as high jumps, horizontal jumps, and low-altitude jumping exercises help activate muscles that produce explosive power, strengthen coordination, and improve the athlete's ability to jump higher and faster (Bafirman, Wahyuri, et al., 2023). Some studies even noted a significant increase in leg muscle explosive power after a structured plyometric exercise program. Therefore, the use of plyometric exercises as a potential method in increasing the explosive power of limb muscles of SMPN 2 Bantan volleyball students is relevant to the latest developments in sports science.

Motivation is an important factor in achieving high sports achievement. Recent research has highlighted the role of motivation in improving athletes' performance. Highly motivated students tend to have a stronger focus, and discipline in undergoing training programs and are more persistent in facing challenges. In addition, motivation can also affect the extent to which students respond to and adopt certain exercises. Therefore, this study that incorporates an analysis of students' motivation levels in undergoing plyometric exercise and its impact on the explosive power of their leg muscles will provide additional insight into how motivation plays a role in the context of sports training (Sopa, 2019).

The main purpose of this study was to investigate the effect of plyometric exercises, in the form of Quick Leap and Depth Jump, as well as the level of motivation of SMPN 2 Bantan volleyball extracurricular students on increasing the explosive power of leg muscles. This study aimed to understand how both types of plyometric exercises affect students' physical abilities in the context of volleyball, while also delving into how individual motivation levels can moderate the influence of those exercises. Thus, this study aims to provide deeper insights into the relationship between physical exercise and motivation and its implications in the development of athletic skills and student well-being in extracurricular sports activities in schools.

Through this research, it is hoped that a better solution will be found in increasing the explosive power of the limb muscles of SMPN 2 Bantan volleyball extracurricular students. The results of this study will provide a deeper understanding of the relationship between plyometric exercise, motivation, and leg muscle explosive power, which can help coaches and PE teachers in designing training programs that are more effective and appropriate to the needs of student-athletes.

METHOD

This study uses a type of quasi-experimental research with a 2x2 factorial design. A factorial experiment is an experimental design that involves two or more independent variables and considers the presence of a moderator variable that affects the outcome or a dependent variable. This study used a quasi-experimental design. The study population consisted of all 60 extracurricular volleyball students of SMPN 2 Bantan. The sample in this study consisted of 32 extracurricular volleyball students of SMPN 2 Bantan. This sample was selected after dividing groups based on motivation

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levels, namely 16 people with high levels of exercise motivation and 16 people with low levels of exercise motivation.

In this study, two types of instruments were used. First, the limb muscle explosive power test uses vertical jumps to measure students' physical abilities. Second, a Likert scale questionnaire was used to measure students' motivation levels. The data obtained will be analyzed using a two-track analysis of variance (ANOVA) to examine the effect between the types of plyometric exercises (Quick Leap and Depth Jump) and the level of motivation on the explosive power of the leg muscles. Next, this analysis will be followed by the Tuckey test to evaluate the differences between the groups.

RESULTS AND DISCUSSION

Result

Data Description

In this section, a description of leg muscle explosive power data on extracurricular volleyball students of SMP Negeri 2 Bantan will be presented which is the result of measurements of all research subjects. Based on the experimental research design conducted, there are 8 (eight) groups of members whose limb muscle explosive power results score needs to be described separately. The following is presented a description of the results of the explosive power of the limb muscles from the eight groups.

Results of Limb Muscle Explosive Power of Volleyball Extracurricular Students of SMP Negeri 2 Bantan Who Were Given Quick Leap Training (A_1). Data from the measurement of leg muscle explosive power results in extracurricular volleyball students of SMP Negeri 2 Bantan in this group consisting of 16 members (n = 16) the highest score of 90, the lowest score of 31, the average score of 67.63 and standard deviation of 18.71. Frequency distribution of limb muscle explosive results in students of SMP Negeri 2 Bantan.

The results of leg muscle explosive power of extracurricular volleyball students of SMP Negeri 2 Bantan who were given depth jump (A2) exercises. The data from the measurement of the explosive power jump of leg muscles in this group consisted of 16 members (n = 16) the highest score of 84, the lowest score of 49, the average score of 67.93, and the standard deviation of 12.29. The frequency distribution of the results of the explosive power jump of the limb muscles.

Results of the Leap in the Explosive Power of the Limb Muscles of Volleyball Extracurricular Students of SMP Negeri 2 Bantan High Motivation Category (B1). The data from the measurement of the explosive power jump of the limb muscles in this group consisted of 16 members (n = 16) with the highest score of 90, the lowest score of 49, the average score of 71.97, and the standard deviation of 14.10. Frequency distribution of leg muscle explosive results of extracurricular students of SMP Negeri 2 Bantan.

Results of Limb Muscle Explosive Power of Volleyball Extracurricular Students of SMP Negeri 2 Bantan Low Motivation (B2) Category. The data from the measurement of the explosive power jump of the limb muscles in this group consisted of 16 members (n = 16) with the highest score of 84, the lowest score of 31, the average score of 63.59, and the standard deviation of 16.27. Frequency distribution of leg muscle explosive jumps of extracurricular students of SMP Negeri 2 Bantan.

The results of leg muscle explosive power of volleyball extracurricular students of SMP Negeri 2 Bantan who were given Quick Leap training with the High Training Motivation category (A1B1). The data from the measurement of the explosive power jump of the limb muscles in this group consisted of 8 members (n = 8) with the highest score of 90, the lowest score of 68, the average score of 81.79, and the standard deviation of 8.72.

The results of leg muscle explosive power of volleyball extracurricular students of SMP Negeri 2 Bantan who were given Quick Leap exercises with the Low Training Motivation category (A1B2). The data from the measurement of the explosive power jump of the leg muscles in this group consisted of 8 members (n = 8) with the highest score of 81, the lowest score of 31, the average score of 53.46, and the standard deviation of 14.67. Frequency distribution of leg muscle explosive jumps of extracurricular students of SMP Negeri 2 Bantan.

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The results of leg muscle explosive power of extracurricular volleyball students of SMP Negeri 2 Bantan who were given depth jump training in the category of high training motivation (A2B1). The data from the measurement of the explosive power jump of the limb muscles in this group consisted of 8 members (n = 8) with the highest score of 82, the lowest score of 49, the average score of 62.14, and the standard deviation of 11.38. Frequency distribution of leg muscle explosive jumps of extracurricular students of SMP Negeri 2 Bantan.

The results of leg muscle explosive power of extracurricular volleyball students of SMP Negeri 2 Bantan who were given depth jump exercises with the Low Training Motivation (A2B2) category. The measurement data from the explosive power jump of the limb muscles in this group consisted of 8 members (n = 8) with the highest score of 84, the lowest score of 55, the average score of 73.71, and the standard deviation of 10.84. Frequency distribution of leg muscle explosive jumps of extracurricular students of SMP Negeri 2 Bantan

Test Analysis Requirements

Hypothesis testing in this study was carried out using a two-track analysis of variance (ANOVA). As a requirement, it requires a normality test and a homogeneity test of variance.

Normality Test

The normality test was performed using the Lilliefors test with a real level (α) = 0.05. The test criterion is that reject the null hypothesis if $L_{observation}$ (L_o) obtained from observational data exceeds L_{table} (L_t) and conversely accept the null hypothesis if L_o obtained smaller than L_t in simple terms can be used following formula:

H_O = denied if L_o ($L_{observation}$) > L_t (L_{table}), Instead

H_O = accepted if L_o ($L_{observation}$) < L_t (L_{table})

Table 1. Summary of normality test results of limb muscle explosive power data of students from eight research design groups

Group	N	L_o	L_t	Conclusion
A_1	16	-0.116	0.21	Usual
A_2	16	-0.122	0.21	Usual
B_1	16	-0.105	0.21	Usual
B_2	16	-0.119	0.21	Usual
A_1B_1	8	-0.173	0.285	Usual
A_1B_2	8	-0.184	0.285	Usual
A_2B_1	8	-0.169	0.285	Usual
A_2B_2	8	-0.171	0.285	Usual

Based on the calculation of the normality test of the eight groups of research design above, it was found that the price $L_{observation}$ (L_o) obtained was less than the price L_{table} at a real level of 0.05. Thus, it can be concluded that all data groups in this study are taken from normally distributed populations so that they can be used for testing research hypotheses.

Homogeneity Test of Variance

Another analysis requirement needed in this study is testing the homogeneity of variance. The variance homogeneity testing conducted in this study was: (a) testing the homogeneity of leg muscle explosive power data from two treatment groups, namely between the Quick Leap Training group and the Depth Jump Training group (A1 and A2), (b) testing the homogeneity of leg muscle explosive leap data of the high category exercise motivation group and the low category exercise motivation group (B1 and B2), (c) testing the homogeneity of data on the four cells in the research design, namely cell groups A1B1, A1B2, A2B1, A2B2.

Test of homogeneity of variance of two treatment groups

Testing the homogeneity of variance of the two treatment groups is carried out by calculating the F-ratio between the largest variance and the smallest variance of the tested group by dividing the largest variance by the smallest variance. The calculation result is compared with the F-table price at the significance level α = 0.05.

Based on the results of statistical calculations, the largest variance (S^2) is 349,991 and the smallest variance is 150,991. The index of homogeneity of variance between the two groups tested

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(F_h) is 2.32, while Ft (0.05: 16.16) is 2.40 thus Fh < Ft which means that Ho is accepted. The results of the complete calculation of the homogeneity test can be seen in Appendix 14 page 154. In other words, it can be argued that the two groups tested, namely groups A1 and A2, are homogeneous. A summary of the calculation results can be seen in the table below:

Table 2. Summary of Homogeneity Test Results of Group A1 and A2 Variance

Group		Variance	F_h	F_t	Information
A_1		349.991	2.32	2.4	Homogen
A_2		150.991			

Test Homogeneity of Variance of Two Groups of Exercise Motivation Categories

Testing two groups of exercise motivation categories in this study was also carried out by calculating the F-ratio between the largest variance and the smallest variance from the tested group by dividing the largest variance by the smallest variance. The result of the calculation is compared with the price of Ftabel at the level of significance $\alpha = 0.05$.

The calculation results show that of the two groups compared, the largest variance (S^2) is 198,923 and the smallest variance is 264,612. The index of homogeneity of variance between the two groups tested F_h was 1.33 while F_t (0.05; 16.16) = 2.40. Thus $F_h < F_t$ which means that H_o is accepted. The results of the complete calculation of the homogeneity test can be seen in Appendix 14 page 154. In other words, it can be argued that the two groups tested, namely groups B1 and B2, are homogeneous. A summary of the calculation results can be seen in the table below:

Table 3. Summary of Homogeneity Test Results of Variance Groups B1 and B2

Group		Variance	F_h	F_t	Information
B_1		198.923	1.33	2.4	Homogen
B_2		264.612			

Test Homogeneity Variance of All Four Treatment Cell Groups

The homogeneity test of variance of the four treatment data groups was performed using the Bartlett test. The test criterion is to accept Ho if the X_2 count is smaller than the X_2 table at the significance level $\alpha = 0.05$. The four treatment groups in question are; 1) group members trained with quick leap exercise with high exercise motivation (A1B1), 2) group members trained with quick leap with low training motivation (A1B2), 3) group members trained with depth jump exercise with high training motivation (A2B1), 4) group member trained with depth jump exercise with low training motivation (A2B2).

Table 4. Summary of the Results of the Homogeneity Test of Variance of the Four Research Design Groups

Group	Separate Variance	Combined Variance	Price B	X^2h	$X^2t(0.95)$ (3)	Information
A_1B_1	76.02					
A_1B_2	215.08	134.54	59.61	1.92	11.07	Homogeneous
A_2B_1	129.50					
A_2B_2	117.57					

By looking at the table above it can be seen that Ho is accepted ($X2_{count} < H2_{table}$). This means that there is no difference in variance between the four groups tested or in other words that the four groups of data on the explosive power of the muscles tested turned out to be homogeneous.

Hypothesis Testing

Hypothesis testing of this study was carried out with the two-track ANAVA technique. Then further tests were carried out using the Tukey Test. The use of the two-track ANAVA technique aims

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to determine the individual contribution of the independent variable to the experimental results (main effect) and to determine the effect of interaction (interaction effect). The main influences in this study are; 1) the effect of Quick Leap training and Depth Jump training on the explosive power of leg muscles, and 2) the effect of interaction is a combination of training approaches and training motivation on the explosive power of leg muscles. The calculation results of data analysis are presented in the following table:

Table 5. Summary of Two-Path Anava Results against Limb Muscle Explosive Power Data

Source of variance		**JK**	**db**	**RJK**	**F_{count}**	**F_{table}**	**Information**
						a=0,05	
Exercise Approach (A)		562.41	1	562.41	4.2	4.2	Sig
Motivation (B)		0.72	1	0.72	0.01	4.2	
Interaction AB		3185.06	1	3185.06	23.67	4.2	Sig
Deep Fallacy		3767.26	28	134.54	-	-	
Total		7515.44	31		-		

Based on the summary of the results of the calculation of ANAVA in the two lines above, it can be stated that:

1. The first hypothesis states the effect of the Quick leap training approach and Depth jump training on the explosive power of the limb muscles of SMPN 2 Bantan volleyball extracurricular students. accepted, because the calculation results show that F_{count} = 4.20 > F_{table} = 4.20. It can be seen from the difference in the average A1 smaller 67.63 < A2 67.93, because of the poor explosive power of the leg muscles of extracurricular volleyball students of SMPN 2 Bantan.
2. The second hypothesis that there is an interaction between the exercise approach and exercise motivation in its effect on the explosive power of the leg muscles, is accepted. Because the calculation results show that F_{ount} = 23.67 > F_{table} = 4.20. It can be concluded that there is an influence of interaction between the training approach and training motivation on the explosive power of the limb muscles of SMPN 2 Bantan volleyball extracurricular students.

With the proof of the research hypothesis that states that there is an interaction between the training approach and exercise motivation on the explosive power of the limb muscles of SMPN 2 Bantan volleyball extracurricular students, the analysis needs to be continued with the Tukey Test.

Table 6. Advanced ANAVA Results with Tukey Test

Comparison group	Qh	Qt (= 0.05)	information
A_1B_1 and A_2B_1	4.79	4.04	Significant
A_1B_2 and A_2B_2	4.94	4.04	Significant

Based on the results of further tests using the Tukey Test above, it can be stated that:

3. The third research hypothesis states that there is a difference in the effect of a quick leap with high-category exercise motivation (A1B1) is better than a depth jump with high-category exercise motivation (A2B1) on the explosive power of the limb muscles of SMPN 2 Bantan volleyball extracurricular students is accepted. This can be seen from the average explosive power score of the limb muscles of SMPN 2 Bantan volleyball extracurricular students in the A1B1 = 81.79 and A2B1 = 62.14 groups (Qh = 4.79 > Qt = 4.04). So it can be understood that in the quick leap training approach, the high-category motivation group (A1B1) is better than the depth jump training approach of the high-category motivation group (A2B1).
4. The fourth research hypothesis states that in the low category exercise motivation the depth jump training approach (A2B2) is better than the quick leap training approach, the low category exercise motivation (A1B2) on the explosive power of the limb muscles of SMPN 2 Bantan volleyball extracurricular students is accepted. This can be seen from the average explosive score of the limb muscles of SMPN 2 Bantan volleyball extracurricular students members of the A2B2 = 73.71 group greater and has a significant influence than from A1B2 = 53.46 with a value (Q_h = 4.94 > Q_t = 4.04).

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So it can be understood that in the low category of exercise motivation, the depth jump training approach (A_2B_2) is better and has a significant influence than the quick leap training approach (A_1B_2) on the explosive power of the leg muscles of SMPN 2 Bantan volleyball extracurricular students.

Discussion

The results of this study revealed several significant findings related to the effect of plyometric training and motivation on the explosive power of the limb muscles of volleyball extracurricular students at SMPN 2 Bantan. First, overall, there was a significant difference in the effect between the two types of plyometric exercises used, Quick Leap and Depth Jump, on the explosive power of students' leg muscles. These results suggest that both types of plyometric exercises have a positive impact on improving the explosive power of leg muscles, but there are differences in how effective they are (Astuti, 2020).

In addition, another interesting finding was the significant interaction between the type of plyometric exercise and the level of motivation of students to the explosive power of leg muscles (Amalia, 2019; Ma'sum et al., 2020). These results suggest that students' motivation levels may influence the extent to which plyometric exercises will successfully increase the explosive power of their limb muscles. More specifically, in the group of students with high levels of motivation, the plyometric Quick Leap exercise was more effective in increasing the explosive power of the limb muscles than the plyometric Depth Jump exercise. In contrast, in the group of students with low levels of motivation, the Depth Jump plyometric exercise was more effective than the Quick Leap plyometric exercise (Broto, 2015).

These findings have important implications for designing a more effective training program for volleyball extracurricular students at SMPN 2 Bantan. Coaches and PE teachers can consider a student's motivation level when choosing the type of plyometric exercise that works best for them. In addition, the study also underscores the importance of understanding motivational factors in the achievement of athletic achievement, as students' motivation levels can significantly affect their training outcomes. Thus, the results of this study provide more in-depth and relevant guidance in increasing the explosive power of leg muscles of volleyball students at SMPN 2 Bantan, taking into account the important role of exercise and motivation factors.

An in-depth interpretation of the results of this study reveals several findings that have important implications in the context of developing sports training programs, particularly for extracurricular volleyball students (Islami et al., 2022; Saputra et al., 2018). First of all, the significant difference in influence between the plyometric Quick Leap and Depth Jump exercises highlights the importance of selecting appropriate training methods based on the individual characteristics of students. For students with high levels of motivation, Quick Leap can be considered more effective in increasing the explosive power of leg muscles, while Depth Jump is more effective for students with low levels of motivation. This suggests that a more personalized approach tailored to individual characteristics can yield better results in the development of leg muscle strength (Prakoso, 2019).

Then, the significant interaction between the type of plyometric exercise and the student's motivation level underscores the important role of motivation in achieving optimal results in sports training (Sovensi et al., 2020). These results encourage coaches and PE teachers to consider not only the physical and technical aspects of training but also psychological aspects such as student motivation. In this context, there needs to be a holistic approach to athlete development that includes motivation as a key factor in achieving sporting achievement (Bafirman, Munir, et al., 2023). By understanding that motivation can influence response to plyometric exercises, training programs can be better tailored to maximize students' potential and encourage them to achieve higher achievements in volleyball (Hermanzoni, 2020).

In addition, the study also underscores the importance of involving students in the process of developing their training programs. In an extracurricular context, understanding students' motivation levels and their preferences for specific exercises can allow coaches to create a more positive and supportive environment, which in turn can increase students' involvement in training and strengthen their passion for participation in sports (Arianti, 2018). Awareness of the role of motivation in sports training can help create more meaningful experiences and build a strong foundation for athletes' future development.

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To compare the results of this study with similar previous studies, several key differences in methods, populations, and results must be noted. First of all, this study focused on the effect of two types of plyometric exercises, namely Quick Leap and Depth Jump, on the explosive power of the limb muscles of volleyball extracurricular students. Previous research may have focused more on one type of plyometric exercise or may have incorporated more variations of exercise. This suggests that the study provides more specific insights into the effectiveness of both types of exercise (A. Putra & Rafki, 2020).

Second, the results of this study highlight the important role of students' motivation levels in response to plyometric exercises. This is an aspect that was less emphasized in previous studies that focused more on physical or engineering factors. These results add an important psychological dimension to the understanding of sports training and may aid the development of more holistic training programs. In addition, in terms of the study population, the study limited the sample to only volleyball extracurricular students, while previous studies may have covered a variety of different age groups or sports. This may affect the generalizability of the results of this study to the wider population. However, the study provides deeper insights into sports conditions in particular, which can be an important reference for coaches and PE teachers.

In terms of study design, it is important to note that this study used an experimental design with a control group, which allowed the study to determine causality in the effect of plyometric exercise on the explosive power of leg muscles. Some previous studies may have used different designs or even just observational analyses. This makes the results of this study stronger in supporting its claims. Finally, the results of this study provide recommendations that can be used by coaches and PE teachers in developing training programs that are more tailored to students' needs. This offers potential improvements in the development of young athletes and encourages a more personalized approach to sports training. In conclusion, this study contributes to a deeper understanding of the effect of plyometric exercise on volleyball extracurricular students and offers a valuable contribution in the development of more effective sports training programs.

CONCLUSION

From the results of this study, it can be concluded that the plyometric training approach, especially Quick Leap and Depth Jump, affects the explosive power of the limb muscles of SMPN 2 Bantan volleyball extracurricular students in different ways depending on the level of student motivation. Results showed that when students had high levels of exercise motivation, the Quick Leap training approach was more effective in increasing the explosive power of leg muscles compared to the Depth Jump. However, when students have low levels of exercise motivation, the Depth Jump training approach is more effective in achieving increased limb muscle explosiveness compared to the Quick Leap. These results illustrate the importance of considering an individual's level of motivation in designing an appropriate exercise program, as motivation can influence the impact of certain types of exercise.

In addition, this study also confirmed a significant interaction between the plyometric exercise approach and the level of exercise motivation in influencing the explosive power of leg muscles. These findings provide a deeper understanding of the importance of personalizing exercise programs in sports, taking into account not only the type of exercise used but also individual motivation. In the context of athletic skill development, these results can provide valuable guidance for sports coaches and educators in designing more effective exercise programs focused on optimal volleyball athlete development.

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