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The Effect of Push-Up Variation Training on the Shooting Ability of Basketball Players Among Ninth-Grade Students at Reformasi Plus Noelbaki Junior High School

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Abstract

This study employed a quantitative research method using a one-group pretest–posttest design to determine the effect of push-up variation training on the shooting ability of basketball players among ninth-grade students at Reformasi Plus Noelbaki Junior High School. The population of this study consisted of all students of Reformasi Plus Noelbaki Junior High School. The sample was limited to 20 male students. Data collection was conducted to measure arm muscle strength through push-up variation exercises and to assess basketball shooting ability before and after the treatment. Data analysis and hypothesis testing were performed using the paired sample t-test. The results showed that there was a significant difference between the pretest and posttest scores after the implementation of push-up variation training. The calculated t-value was 49.00, which was greater than the t-table value (df = 19) of 1.729, and the significance value was $0.00 < 0.05$. The improvement in shooting ability after the push-up variation training reached 87.5%. These findings indicate that push-up variation exercises have a significant positive effect on improving basketball shooting ability.

INTRODUCTION

Basketball is a team sport played by two teams, each consisting of five players. Both teams compete to score points by putting the ball into the opponent's basket as many times as possible. Basketball can be played on an outdoor or indoor court. The international standard for basketball games consists of four quarters, with each quarter lasting 10 minutes (4 × 10 minutes) and a 10-minute halftime break. However, in the NBA competition, the format is different, with each quarter lasting 12 minutes (4 × 12 minutes). The main objective of basketball is to score as many points as possible while preventing the opposing team from scoring. Basketball is an interval sport that requires good aerobic capacity to maintain stable performance throughout the game (Eliakim & Nemet, 2020; Narazaki et al., 2009).

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Basketball is a dynamic and attractive sport, especially in the way the ball is played through dribbling, passing, and shooting. The game becomes even more exciting when players perform shooting techniques such as three-point shots, lay-ups, and slam dunks. There are three basic ways to move the ball in basketball: dribbling, passing, and shooting (FIBA, 2006).

Basic techniques are essential elements in basketball that must be mastered by every player. Among these techniques, shooting is one of the most important skills, as it involves attempting to score points by throwing the ball into the opponent's basket. Victory in basketball is determined by the number of successful shots; therefore, shooting is a fundamental skill that must be properly learned and continuously improved through regular training.

This research was conducted at Reformasi Plus Noelbaki Junior High School because basketball participation at the school is very high. However, players still face difficulties in performing shooting techniques effectively. Based on observations during several matches, students demonstrated weaknesses in arm strength when releasing the ball and showed improper follow-through movements. Since shooting is a crucial basic technique in basketball, improving this skill is necessary. One approach to enhancing shooting ability is through appropriate physical training.

Physical training for basketball players includes various exercises designed to strengthen the body. Strength training is particularly important because basketball players rely on full-body muscle engagement. Exercises such as push-ups, sit-ups, planks, chest presses, and pull-ups are part of strength training programs that, when performed regularly, provide positive effects on physical fitness and support improvement in shooting skills.

Strength training is essential in basketball because it enhances muscle power, stability, endurance, speed, and coordination. It also helps prevent injuries and maintain physical condition during matches. Specifically, strength training improves the muscles involved in shooting, such as the shoulders, triceps, and chest muscles, thereby increasing shooting stability, accuracy, and confidence. Therefore, strength training should be performed correctly and in appropriate amounts, combined with physical conditioning and technical training, to achieve optimal results.

The objective of this study is to analyze the effect of push-up variation training on the basketball shooting ability of ninth-grade students at Reformasi Plus Noelbaki Junior High School.

LITERATURE REVIEW

The Nature of Basketball

1. History of Basketball

   Basketball is a team sport played by two teams aiming to score by shooting the ball into the opponent's basket while preventing the opposing team from scoring. It was created in December 1891 by Dr. James Naismith. In Indonesia, basketball is governed by PERBASI (established October 23, 1951; renamed in 1955), which is responsible for the development of basketball nationally.

2. Basic Techniques in Basketball

   Basketball requires mastery of fundamental techniques to achieve optimal performance. According to Imam Sodikin, mastery of basic techniques must be prioritized. The main techniques include: dribbling, passing, shooting, rebounding, defense, lay-up, pivot, and screen.

   Strength (strength) is defined as the maximal muscle contraction force in a single effort against resistance. It is essential in sports performance, injury prevention, and supports other physical components such as power, agility, and speed (Bompa & Buzzichelli, 2019; Fenanlampir, 2020).

3. Shooting Technique

Shooting is a crucial skill in basketball (Wissel, 2011). The basic principles are similar to passing techniques. Types of shooting include:

a. One-hand set shot
b. Free throw
c. Three-point shot
d. Lay-up shot (Adii et al., 2023).

Key shooting elements include hand position, focus, balance, rhythm, and the BEEF concept: Balance, Elbow, Eyes, Follow Through (Oliver, 2004).

4. Basketball Facilities
   a. Court: 28 m × 15 m (Official Basketball Rules, 2010).
   b. Backboard: 1.80 m × 1.20 m, flat surface (Gunawan et al., 2021; Harliawan, 2024).
   c. Ball: Size 7 for men, size 6 for women (Hidayatullah et al., 2023).

Physical Condition

Physical condition includes strength, endurance, power, speed, flexibility, agility, coordination, balance, muscular power, and reaction. This study emphasizes strength, defined as maximal muscle contraction in a single effort (Prima & Kartiko, 2021).

Components of Physical Fitness

Key components include:

1. Strength (Saharullah, 2020; Wiarto, 2021)
2. Muscular Power (Sajoto, 2021)
3. Endurance (Sajoto, 2021)
4. Speed
5. Power (Solissa, 2025; Wiguna, 2023)
6. Balance
7. Flexibility (Pasaribu, 2020; Suharjana, 2013)
8. Agility
9. Coordination
10. Reaction

The Nature of Training

Training is a systematic, long-term, progressive, and individualized physical activity process aimed at improving physiological and psychological performance (Bompa & Buzzichelli, 2019). Training sessions generally include: warm-up, core training, supplementary exercises, and cool-down. Training aims to improve physical fitness and performance (Suharjana, 2013).

Push-Up Exercise

Push-up is an exercise to strengthen arm muscles. It involves maintaining a prone plank position and pushing the body upward using arm strength. Target muscles include pectoralis major, deltoid, triceps, biceps, rhomboid, trapezius, and serratus anterior (Rumawatine et al., 2024).

Push-Up Variations

Push-up variations target different muscle groups (Cahyono et al., 2018), including:

1. Regular push-up
2. Wide-hand push-up
3. Incline push-up

4. Decline push-up
5. Diamond push-up

Each variation emphasizes different areas of the chest, shoulders, triceps, and core.

Relevant Studies

1. (Aulia, 2023) found that arm muscle strength training significantly improved three-point shooting performance.
2. (Amri & Supratman, 2023) found that push-up training significantly improved three-point shooting ability using a One Group Pretest–Posttest Design.
3. (Akbar Rambe, 2023) found that push-up and pull-up training significantly influenced basketball shooting ability.

Conceptual Framework

Based on the theoretical review, push-up variation training is expected to improve arm strength, which in turn enhances basketball shooting ability in students of SMP Reformasi Plus Noelbaki.

Research Hypothesis

H0 : Push-up variation training does not significantly affect basketball shooting ability among Grade IX male students of SMP Reformasi Plus Noelbaki.

Ha : Push-up variation training significantly affects basketball shooting ability among Grade IX male students of SMP Reformasi Plus Noelbaki.

METHOD

Research Location and Time

This research was conducted at SMP Reformasi Plus Noelbaki, located at Jln. Timor Raya Km 14.5, Noelbaki – Kupang Tengah District, Kupang Regency, NTT.

The subjects were Grade IX students in the 2025/2026 academic year. The research was conducted in September 2025. The number of students was sufficient to serve as the research population.

Research Design

This study used a pre-experimental method with a One Group Pretest–Posttest Design (Sugiyono, 2019).

Design structure:

O1 = Pretest (shooting ability before treatment)
X = Push-up variation training
O2 = Posttest (shooting ability after treatment)

The treatment effect is calculated as (O2 – O1). Research steps:

1. Pretest – Initial shooting ability test.
2. Treatment – Five push-up variations: regular, wide hands, incline, decline, and diamond push-ups.
3. Posttest – Final shooting ability test.

There was no randomization, and only one group was used.

Population and Sample

1. Population

   Population refers to all research subjects with specific characteristics (Ahyar et al., 2020). The population consisted of male students actively participating in basketball activities at SMP Reformasi Plus Noelbaki and willing to complete the treatment program.
2. Sample

   The sampling technique used was population sampling (Ahyar et al., 2020). Criteria:
   a. Active in basketball extracurricular activities
   b. Male
   c. Willing to complete treatment
   d. Not injured or sick

   The sample consisted of 20 students. Pretest and posttest results were compared within the same group (Sugiyono, 2017).

Data Collection Technique

Data were collected through tests and measurements. The research lasted 8 training sessions, excluding pretest and posttest.

Instrument Validity

The instrument used logical validity (Azwar, 2010), ensuring that test items represented the measured attributes.

The instrument was a basketball shooting test conducted before and after treatment. Test procedure:

1. Equipment: ring (target), stopwatch, basketball
2. Players shot from five positions (short corner, wing/elbow, free throw, opposite wing/elbow, opposite short corner)
3. Two shots per position
4. Time limit: 1 minute
5. Two test attempts with 1-minute rest
6. Maximum 20 shots
7. Score: 1 point per successful shot

   Final score = total successful shots from both attempts.

Data Analysis Technique

Before hypothesis testing, prerequisite tests were conducted:

1. Normality Test

   Using Shapiro-Wilk test with SPSS 25 (Gazali et al., 2022). Criteria:
   a. Sig. $>$ 0.05 → Data are normal
   b. Sig. $<$ 0.05 → Data are not normal
2. Homogeneity Test

   Using F-test with SPSS 25. Criteria:
   a. Sig. $>$ 0.05 → Homogeneous
   b. Sig. $<$ 0.05 → Not homogeneous
3. Hypothesis Testing

   Used t-test (paired sample t-test) (Ananda & Fadhli, 2018). Criteria:
   a. t-count $>$ t-table and sig. $<$ 0.05 → Ha accepted
   b. t-count $<$ t-table and sig. $>$ 0.05 → Ha rejected

Percentage increase formula:
Percentage Increase = (Mean Difference / Mean Pretest) × 100%
Mean Difference = Mean Posttest – Mean Pretest

Research Procedure

Based on Sugiyono (2021), the research stages included:

1. Preparation (proposal development)
2. Sample identification
3. Pretest
4. Treatment (push-up variation training)
5. Posttest
6. Data analysis (t-test)
7. Reporting

Training Program

The training program consisted of 8 sessions, including:

1. Regular push-up (2–3 sets × 10 reps)
2. Wide hands push-up (3–4 sets × 10 reps)
3. Incline push-up (3–4 sets × 10 reps)
4. Decline push-up (4 sets × 10 reps)
5. Diamond push-up (4 sets × 10 reps)

Each session included prayer, stretching, warm-up, core training, cool-down, and briefing. Rest intervals ranged from 3–5 minutes between sets. The program aimed to improve arm strength to enhance basketball shooting performance.

RESULT AND DISCUSSION

Description of Research Location

SMP Reformasi Plus Noelbaki is a private junior high school located at Jln. Timor Raya Km. 14.5, Noelbaki – Kupang Tengah District, Kupang Regency, NTT, Indonesia. The school was established in 2003 and received B accreditation in 2020. It is managed by the Reformasi Noelbaki Education Foundation. The principal for the 2019–2025 period is Dance Matashina, S.Pd., K.Gr.

The school has various academic and non-academic achievements, including national-level competitions in speech, poetry writing and reading, and sports competitions such as futsal (2nd place at national level). Facilities include a library, science laboratory, and sports fields (football, basketball, volleyball). Extracurricular activities include futsal, music, volleyball, and basketball.

Vision and Mission

1. Vision

   To excel in academic achievement, innovative and creative practical skills, and character development based on strong Reformed Christian faith.
2. Mission

   Strengthening understanding and practice of Reformed Christian faith, improving active and innovative God-centered learning, enhancing academic and non-academic achievements, developing English proficiency and life skills, and increasing stakeholder participation in school management.

Data Description

Arm muscle strength training aims to increase muscle strength and maintain bone density around the arms and shoulders. Examples include push-ups, pull-ups, plank, bench dips, and dumbbell shoulder presses. This study specifically used push-up variation exercises.

Pretest and posttest are evaluation methods used to measure participants' ability before and after treatment (Arikunto, 2016).

The basketball shooting ability test was conducted before and after the implementation of push-up variation training. The results of the pretest and posttest shooting scores are presented in the following table.

Table 1. Posttest and Pretest Scores

No	Child's Name	Pretest Score	
		Pretest (X_1)	*Posttest* (X_2)
1.	Ardiles	6	11
2.	Bintang	4	9
3.	Vito	5	10
4.	Frans	9	13
5.	Nhegi	7	12
6.	Resto	3	8
7.	Wiliam	4	9
8.	Yohan	5	10
9.	Kenay	9	13
10.	Rian	7	12
11.	Lukas	5	10
12.	Jery	8	13
13.	Simon	2	8
14.	Melky	6	11
15.	Ricko	4	9
16.	Nofen	5	10
17.	Alen	9	13
18.	Vicky	7	12
19.	Valen	3	8
20.	Jasen	4	9

Source: Research Results 2025

Prerequisite Test Results

Data analysis for hypothesis testing requires several prerequisite tests to ensure the validity of the results. These prerequisite tests include:

1. Normality Test

   To test the normality of the data, the Kolmogorov-Smirnov test was used. If the data are normally distributed based on the Kolmogorov-Smirnov test, then parametric statistics (such as regression and correlation analysis) can be applied. However, if the data are not normally distributed, non-parametric statistics, such as the Shapiro-Wilk test, are used.

   Based on the results of the normality test using the Kolmogorov-Smirnov formula through SPSS 25 computer analysis, the following results were obtained.

Table 2. Normality Test Results

Tests of Normality

	Class	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Shooting Score	Pre Test Shooting bola basket	.160	20	.194	.901	20	.042
	Post Test Shooting bola basket	.162	20	.180	.942	20	.257

a. Lilliefors Significance Correction

Source: Processed research data using SPSS 25

The table above shows that the Pretest Shooting ability score (X1) and the Posttest Shooting ability score (X2) both have significance values greater than 0.05. This indicates that both research data sets are normally distributed.

2. Homogeneity Test

The homogeneity test is used to determine whether the sample variances are equal (homogeneous) or not.

Homogeneity criteria:

a. If (sig.) > 0.05 → the data are homogeneous
b. If (sig.) < 0.05 → the data are not homogeneous

The results of the homogeneity test are presented in the following table.

Table 3. Results of Homogeneity Test

Test of Homogeneity of Variance

		Levene Statistic	df1	df2	Sig.
Shooting Score	Based on Mean	.468	1	38	.498
	Based on Median	.275	1	38	.603
	Based on Median and with adjusted df	.275	1	35.945	.603
	Based on trimmed mean	.474	1	38	.495

Source: Data processing using SPSS 25

Based on Table 3 above, the pretest and posttest shooting ability scores of basketball players at SMP Reformasi Plus Noelbaki show a significance value greater than 0.05 (sig. > 0.05). Therefore, the data are considered homogeneous.

3. Hypothesis Testing Results

The hypothesis in this study was tested using a paired sample t-test. The hypothesis analysis was conducted with the assistance of SPSS 25 for Microsoft Windows.

The results of the hypothesis test are explained as follows.

Table 4. Hypothesis Test Results

Paired Samples Test				
Paired Differences			T	Df

		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				Sig. (2-tailed)
					Lower	Upper			
Pair 1	pretest shooting bola basket - posttest shooting bola basket	4.900	.447	.100	4.691	5.109	49.00	19	.000

Source: SPSS 25 data research management

Based on the analysis results in Table 4.5, it was found that t-count = 49.00 > t-table (df = 19) = 1.729, with Sig. (2-tailed) = 0.00 < 0.05. This indicates a highly significant difference. Therefore, the alternative hypothesis (Ha) is accepted, stating that there is a very significant difference in basketball shooting ability before and after the training intervention.

Practically, this confirms that the training program provided was effective and had a significant positive effect in improving the basketball shooting ability of the research subjects.

Discussion

Based on the results of data analysis, description, hypothesis testing, and discussion, it can be concluded that:

There is a significant effect between the pretest and posttest results of push-up variation training on the basketball shooting ability of students at SMP Reformasi Plus Noelbaki. This is shown by t-count = 49.00 > t-table (df = 19) = 1.729 and p-value = 0.00 < 0.05.

The percentage increase in shooting ability after the push-up variation training was 87.5%.

Implications of the Research Results

This study has important implications for teachers or coaches who aim to improve shooting accuracy among Grade IX students. Attention should be given to using varied training methods, particularly push-up variation exercises, to enhance shooting performance.

The implications are as follows:

1. Theoretical Implications

   This study provides scientific evidence regarding the effect of push-up variation training on shooting strength and ability. It can serve as a reference in planning and implementing training programs. Additionally, it offers practical information for physical education teachers and coaches in the field.
2. Practical Implications
   a. The results of this study can be used as reference material and comparison for future researchers.
   b. The findings can support the development of shooting skills, particularly within school extracurricular basketball programs.

Research Limitations

Although this study was conducted as carefully as possible, several limitations exist:

1. The participants were not supervised outside school hours, so some may have practiced independently beyond the treatment program.

2. The researcher could not fully control other factors that might influence test results, such as physical condition, psychological factors, and other external variables.

CONCLUSION

Based on the results of data analysis and discussion, it can be concluded that push-up variation training has a highly significant relationship with and positive effect on basketball shooting ability among male Grade IX students of SMP Reformasi Plus Noelbaki. The findings indicate that increased arm strength through push-up variations contributes meaningfully to improved shooting performance. Additionally, participation in basketball extracurricular activities supports the development of students' shooting skills, as reflected in the average shooting test results.

Based on these conclusions, it is suggested that physical education teachers pay close attention to strength components when aiming to improve students' shooting ability in basketball. Future researchers are encouraged to examine other influencing factors that were not explored in this study. Since the sample was limited to male students, further research involving broader samples and additional related variables is recommended to obtain more comprehensive information for designing effective basketball training programs.

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