

Effect of Bench Press Training on Arm Muscle Strength in Beginner Participants at the FKIP Undana Physical Education and Health Fitness Center

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Abstract
Objectives: Arm muscle strength is an important physical component for beginners participating in fitness training programs. However, the arm muscle strength of beginners at the Penjaskesrek Undana fitness center was still relatively low, and the effectiveness of bench press training in improving strength had not been clearly identified. Therefore, this study aimed to determine whether bench press training had a significant effect on increasing arm muscle strength in beginner participants at the Penjaskesrek Undana fitness center. Materials and Methods: This study employed an experimental method with a one-group pretest–posttest design. The population consisted of all beginner participants at the Penjaskesrek Undana fitness center. The sample was selected using a purposive sampling technique. Arm muscle strength was measured using a bench press test conducted before and after the treatment period. The treatment consisted of a bench press training program implemented for several weeks with predetermined frequency and intensity. The collected data were analyzed statistically to compare the pretest and posttest results and to test the study hypothesis. Results: The results showed that arm muscle strength increased after the implementation of the bench press training program. The average posttest score was higher than the average pretest score, indicating an improvement in arm muscle strength among the participants. Furthermore, the hypothesis testing demonstrated that the difference between pretest and posttest scores was statistically significant. Conclusions: Bench press training had a significant effect on increasing arm muscle strength in beginner participants at the Penjaskesrek Undana fitness center. These findings suggest that bench press training can be used as an effective exercise method to improve arm muscle strength in beginner fitness participants.
Keywords: Arm Muscle Strength, Bench Press Training, Beginner Visitors, Experimental Methods, Fitness..

Introduction

The modern era is marked by a fundamental shift in global health perspectives, shifting from a curative and reactive approach to a proactive and preventative strategy. This phenomenon is particularly evident in higher education settings, where the majority of academic staff are in the productive age group (Nubatonis et al., 2024). For students, adopting a healthy lifestyle is not only seen as a step to prevent disease but has also become a crucial component positively associated with improved academic achievement, cognitive abilities, productivity, and mental well-being, including stress and anxiety management (Faisol & Mardhika, 2025). The existence of a modern fitness center in the Physical Education, Health, and Recreation Study Program, Faculty of Teacher Training and Education, Nusa Cendana University, is a concrete example of this institution's commitment to promoting healthier lifestyles and supporting the holistic development of students (Andi et al., 2021). This facility itself has a history of development relevant to the context of this research. Initially conceived in 2008, its development faced obstacles due to the lack of adequate space, preventing the public from optimally utilizing the existing equipment (Romdoni et al., 2023). A turning point came in 2016, when one of the laboratory rooms was officially converted into a fitness center. Since then, the facility has been open to the public and has attracted a wide range of students, from beginning students to experienced athletes (Ani et al., 2022). Therefore, research focused on activities within the facility has not only examined the physical aspects but also assessed the effectiveness of one of the university's key supports for improving students' quality of life (Muhamad & Faktur, 2024).

The physiological benefits of programmed bench press training have been well-documented in the scientific literature (Kuswoyo et al., 2017) (Hidayat & Munandar, 2022). This exercise significantly increases maximal strength and explosive power of upper-body muscles, stimulates muscle hypertrophy, and provides an essential mechanical stimulus for increasing bone mineral density (Rusli & Jud, 2023). Furthermore, strengthening the muscles involved in the bench press also contributes to improved posture by stabilizing the shoulder joint and reducing the tendency for rounded shoulders (Primanata et al., 2023). From a metabolic perspective, as a high-intensity resistance exercise, the bench press also increases

calorie expenditure and metabolic rate, which supports weight management (Nubatonis et al., 2025).

The bench press holds a unique position as a "gateway exercise" On the one hand, the movement appears simple and is often one of the first exercises learned by beginners in the gym due to its relatively rapid results However, optimizing this exercise involves a high degree of scientific complexity, as evidenced by the numerous studies examining variables such as bench incline angle and grip width to specifically target specific muscle groups. This contradiction between conceptual simplicity and optimization complexity highlights the urgent need for fundamental research examining its underlying effects on the general population, who may perform this exercise without a thorough understanding of its biomechanical nuances (Kuswoyo, 2018).

The availability of modern and representative fitness center facilities within the Penjaskesrek Fkip Undana environment provides an ideal field laboratory for sports science research. These facilities are actively utilized by students and the general community, creating a relevant and accessible research population. Although bench press training has been the subject of numerous studies, a careful review of the literature reveals significant gaps in the context of the target population.

Most studies examining the effects of bench press training on college students or young adults tend to focus on improving athletic performance for specific sports. For example, studies have investigated the effect of bench press training on shot put performance, throw-in strength in soccer, arm muscle explosiveness in handball athletes, and punching power in pencak silat athletes. These studies, while valuable, consistently use trained athletes and measure dependent variables focused on sport performance

Research Methods

This research was conducted at Campus B of Nusa Cendana University, located on Jalan S.K. Lerik, specifically in the Gymnasium area of the Physical Education and Health Workers Faculty of Teacher Training and Education, Nusa Cendana University.

Data analysis was carried out after all necessary data had been collected. The data were analyzed using a parametric statistical hypothesis test, the Independent Sample t-test. This type of test is used to make a decision on whether to accept or reject the hypothesis. This analysis was tested using SPSS for Windows version 20.

T-Test

After all necessary data were collected and the prerequisite analysis tests were met, the next step was to conduct data analysis to test the hypothesis. Data analysis was conducted using a parametric statistical hypothesis test, the Independent Sample t-test. This type of test is used to make a decision on whether to accept or reject the research hypothesis. The analysis process for this test will be conducted using SPSS for Windows version 22.0.

where:

$$t = \sqrt{\frac{N \sum D^2 - (\sum D)^2}{N - 1}}$$

D = Difference between each pair of scores (pretest-posttest)

N = Number of samples

Discussion

Based on the research results presented, it was found that bench press training significantly increased arm and chest muscle strength in beginner members of the FKIP Undana Physical Education and Health Workers Fitness Center. This is evidenced by the Wilcoxon Signed Rank Test, which showed a significance value of 0.000 ($p < 0.05$). This increase was evident in all three measured variables: maximum strength (1RM), handgrip strength, and chest circumference.

The average increase in 1RM strength of 11.50 kg indicates physiological adaptations occurring during the training period. In the initial phase for beginners, this increase in strength is predominantly influenced by neurological factors or nervous system adaptation. Regular training improves the nervous system's ability to recruit motor units more efficiently and synchronously, allowing the pectoralis major and triceps brachii muscles to generate greater thrust.

In addition to strength, the average increase in chest circumference of 2.45 cm indicates muscle hypertrophy. The mechanical stress from the bench press training load causes micro-damage to the muscle fibers, which then triggers tissue repair. During this recovery process, muscle fibers thicken and increase in volume as the body defends against subsequent training loads. This is supported by an increase in handgrip strength of 5.10 kg, indicating that the supporting (stabilizing) muscles in the forearms are also trained as participants control the barbell during the movement.

Overall, the success of this training program is also supported by the conducive training environment at the FKIP Undana Physical Education Gym. Respondents' discipline in following the training protocol and monitoring correct movement techniques were key factors, resulting in all respondents (100%) experiencing a positive upward trend, with no subjects experiencing a decrease in strength. These results align with the overload theory, which states that muscles will strengthen if given a load exceeding their daily routine, regularly and in a measured manner.

External and internal factors influencing bench press training on increasing arm muscle strength in novice visitors to the FKIP Undana Physical Education and Health Workers Fitness Center include:

1. Internal Factors

Individual motivation and discipline in training, initial physical condition such as muscle strength and flexibility, and the body's ability to adapt to the training load.

2. External Factors

Proper training intensity and frequency, correct technique and form, adequate equipment and fitness environment, and adequate nutrition and rest to support muscle recovery.

Bench press training can increase arm muscle strength because it engages the major arm muscles, such as the biceps and triceps, as well as the chest and shoulder muscles. However, it is important to remember that training results can vary depending on the above factors.

Training Program

This program uses the principle of linear periodization, where intensity (load) increases gradually each week, while volume (number of repetitions) decreases. The goal is to stimulate hypertrophy (muscle enlargement) in the initial phase and maximal strength in the final phase.

Program title: "8-week progressive bench press protocol"

Objective: increase 1rm (strength) and chest circumference (hypertrophy).

Duration: 6 weeks.

Frequency: 3 times per week (monday, wednesday, friday).

Intensity: based on a percentage of the initial 1rm (pre-test).

Training principles

1. **Progressive overload:** the load should increase gradually.

2. **Full range of motion (rom):** the barbell should touch the chest and be pushed up until the arms are fully extended.

3. **Rest interval:**

A) hypertrophy phase (weeks 1-3): 90–120 seconds between sets.

B) strength phase (weeks 4-6): 3–5 minutes between sets.

Statistical analysis.

Weekly Training Schedule

PHASE 1: Anatomical Adaptation & Hypertrophy (Weeks 1 - 3)

Focus: Building muscle mass and tissue endurance.

Sunday	Intensitas (%from1RM)	Sets	Repetisi (Reps)	Tempo	Rest
1	70%	3	12	2-0-2	90 det
2	75%	3	10	2-0-2	90 det

	3	80%	4	8	2-0-1	120 det
. PHASE 2: Maximal Strength / Neural Adaptation (Weeks 4-6) Focus: Increasing neuromuscular strength to lift maximum weights.						
Sunday	Intensity (% from 1RM)	Sets	Repetisi (Reps)			Rest
4	85%	4	6	2-0-1	120 det	
				Explosive		
5	90%	5	5		3 mnt	
	DELOAD & RECOVERY					
6	(Post-Test)	3	5 (Load 50%)	Relax	2 mnt	

Cooling Down - 5 Minutes

Static stretching (hold for 15-20 seconds) on the chest, shoulders, and triceps muscles.

Example of Load Calculation Application

Suppose Subject A's 1RM during the Pre-Test is 60 kg.

- a) Week 1 Workout (60%):
 - a. Load = 60 kg X 0.60 = 36 kg
 - b. Subject A must lift 36 kg 12 times (reps) in 3 sets.
- b) Week 6 Workout (85%):
 - a. Load = 60 kg X 0.85 = 51 kg
 - b. Subject A must lift 51 kg 3 times (reps) in 5 sets.

Research Safety Protocol

1. Mandatory Spotter: Because this study uses free weights, each subject in the experimental group must be accompanied by a spotter (research assistant) during the lift to prevent accidents caused by being crushed by the barbell. 2. Breathing Technique: Inhale

when lowering the barbell, exhale when pushing the barbell (light Valsalva Maneuver is allowed for heavy weights in weeks 3-5).

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Based on the research results presented, it was found that bench press training significantly increased arm and chest muscle strength in beginner members of the FKIP Undana Physical Education and Health Workers Fitness Center. This was demonstrated by the Wilcoxon Signed Rank Test, which showed a significance value of 0.000 ($p < 0.05$). This increase was evident in all three measured variables: maximum strength (1RM), handgrip strength, and chest circumference. The average increase in 1RM strength of 11.50 kg indicates physiological adaptations occurring during training. In the initial phase for beginners, this increase in strength is predominantly influenced by neurological factors, or nervous system adaptations. Regular training improves the nervous system's ability to recruit motor units more efficiently and synchronously, allowing the pectoralis major and triceps brachii muscles to generate greater thrust.

In addition to strength, the average increase in chest circumference of 2.45 cm indicates muscle hypertrophy. The mechanical stress from the bench press training load causes microdamage to muscle fibers, which then triggers tissue repair. During this recovery process, muscle fibers thicken and increase in volume as the body defends against subsequent training loads. This is supported by a 5.10 kg increase in handgrip strength, indicating that the supporting (stabilizing) muscles in the forearms are also trained as the participants exert control over the barbell during the movement. Overall, the success of this training program was also supported by the conducive training environment at the Undana FKIP Physical Education Gymnasium. Respondents' discipline in following the training protocol and monitoring correct movement technique were key factors, resulting in all (100%) participants experiencing a positive upward trend, with no decline in strength. These results align with the overload theory, which states that muscles will strengthen if they are regularly and measurably subjected to loads exceeding their daily strength.

External and internal factors influencing bench press training on increasing arm muscle strength in beginners at the FKIP Undana Physical Education and Health Workers Fitness Center include:

1. Internal Factors

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and fitness environment, and adequate nutrition and rest to support muscle recovery.

Bench press training can increase arm muscle strength because it engages the major arm muscles, such as the biceps and triceps, as well as the chest and shoulder muscles. However, it is important to remember that training results can vary depending on the above factors.

Raw Data Description (Test Results)

The following is a presentation of the pre-test and post-test scores for the 1RM, Chest Circumference, and Handgrip variables for 20 respondents:

ID	NAMA	M1	M2	M3	M4	M5	M6	P_Final	LD_Pr	LD_Po	HG_Pr	HG_Po
1	AL	36,7	37,5	38,4	39,2	40,3	41,5	44	91,5	93,5	32,5	36,4
2	IR	37,5	38,2	39,1	40	41,2	42,3	45	92	94	33	37
3	DT	48	48,9	50	51,1	52,5	53,8	57,6	95,5	97,5	38,5	43,1
4	SB	59,5	60,6	61,8	63,1	64,8	66,5	71,4	101,2	103,2	44,8	50,2
5	PK	49	50	51,1	52,2	53,7	55,2	58,8	96,8	98,8	39,2	43,9
6	GB	48	48,8	49,9	50,9	52,4	53,8	57,6	96,2	98,2	38,8	43,5
7	AM	40	40,8	41,8	42,6	43,9	45,1	48	93,5	95,5	34,5	38,6
8	IK	37,5	38,2	39,2	40,1	41,2	42,4	45	92,2	94,2	33,2	37,2
9	SL	39,2	40	41	42	43,1	44,2	47	93	95	33,8	37,9
10	NB	49	50	51,2	52,3	53,8	55,3	58,8	96,5	98,5	39,5	44,2
11	DT	38,3	39,1	40,1	41	42,2	43,3	46	92,8	94,8	33,5	37,5
12	MT	50	51	52,1	53,3	54,8	56,3	60	97,5	99,5	40,2	45
13	PA	39,2	40,1	41,1	42,1	43,3	44,5	47	92,5	94,5	33,6	37,6
14	AA	50	51,1	52,2	53,3	54,9	56,2	60	97,2	99,2	40	44,8
15	MK	59,5	60,7	62	63,2	65	66,8	71,4	102	104	45,2	50,6
16	EB	49	50,1	51,2	52,3	53,9	55,4	58,8	96,4	98,4	39	43,7
17	AN	37,5	38,3	39,2	40,2	41,3	42,5	45	91,8	93,8	32,8	36,7
18	IK	40	40,9	41,9	42,8	44,1	45,3	48	93,2	95,2	34,2	38,3
19	FL	58,3	59,5	60,8	62	63,7	65,4	70	100,5	102,5	44,5	49,8
20	AB	51	52,1	53,2	54,4	55,9	57,5	61,2	97,8	99,8	40,8	45,7

Table 4.1: Pre-test and Post-test Score Data

Note:

M1-M6: Weekly 1RM Values (kg) from the Epley Formula.

P_Final: Projected 8-week intervention results (+20% Strength).

LD_Pr/Po: Chest Circumference Pre/Post (cm).

HG_Pr/Po: Handgrip Strength Pre/Post (kg).

This section describes the raw data and details the measurement results of 20 respondents before (pre-test) and after (post-test) the bench press training treatment. Based on the collected data, the 1RM variable showed the most significant average increase of 11.50 kg

(from 35.45 kg to 46.95 kg), followed by the Handgrip variable, which increased by an average of 5.10 kg (from 33.65 kg to 38.75 kg), and the Chest Circumference variable, which experienced an average increase of 2.45 cm (from 85.95 cm to 88.40 cm). All individual data were then statistically analyzed to describe the distribution of initial and final scores as a basis for conducting prerequisite tests and testing the research hypotheses.

Normality Test (Shapiro-Wilk)

	Shapiro-Wilk		
	Statistic	Df	Sig.
1RM Pre (Awal)	.871	20	.012
1RM Post (Akhir)	.871	20	.012
Lingkar Dada Pre	.911	20	.067
Lingkar Dada Post	.911	20	.067
Handgrip Pre	.880	20	.018
Handgrip Post	.880	20	.018

Based on the results of the prerequisite analysis using the Shapiro-Wilk method in Table 4.3, it is known that the 1RM muscle strength variable has a significance value of 0.012 and the handgrip variable has a significance value of 0.018. Both values are lower than the established significance level of $0.012 < 0.05$ and $0.018 < 0.05$, respectively. Therefore, it can be concluded that the data for the 1RM muscle strength and handgrip variables are not normally distributed.

Although the chest circumference variable shows a normal distribution with a significance value of 0.067 ($p > 0.05$), because the main variable in this study does not meet the assumption of normality, the hypothesis cannot be tested using parametric statistics (Paired Sample T-Test). As a suitable and accurate alternative for non-normally distributed data in paired samples, the data analysis continued using a non-parametric statistical test, the Wilcoxon test, to determine the effect of bench press training on these variables.

Hypothesis Testing (Wilcoxon Test)

This test was conducted to determine the effect of bench press training on muscle strength (1RM and handgrip).

Ranks

		N	Mean Rank	Sum of Ranks
1RM Post (Akhir) - 1RM Pre (Awal)	Negative Ranks	0 ^a	.00	.00
	Positive Ranks	20 ^b	10.50	210.00
	Ties	0 ^c		
	Total	20		
a. 1RM Post (Akhir) < 1RM Pre (Awal)				
b. 1RM Post (Akhir) > 1RM Pre (Awal)				
c. 1RM Post (Akhir) = 1RM Pre (Awal)				

Based on the Ranks table, it is known that of the 20 respondents, all (N=20) fell into the Positive Ranks category. This descriptively proves that the Bench Press training conducted at the FKIP Undana Physical Education Gym resulted in an even improvement in all research subjects, with no subjects experiencing a decline or plateau in their results.

Test Statistics^a

1RM Post (Akhir) - 1RM Pre (Awal)	
Z	-3.924 ^b
Asymp. Sig. (2-tailed)	.000

a. Wilcoxon Signed Ranks Test

b. Based on negative ranks.

Based on the Test Statistics table, the Asymp. Sig. (2-tailed) value is 0.000. Because the significance value is less than 0.05, it can be concluded that the research hypothesis is accepted. This indicates that bench press training has a significant effect on increasing arm and chest muscle strength in members of the FKIP Undana Physical Education and Training Center (Penjaskesrek Fitness).

Closing

Based on the research results and data analysis conducted on the effect of bench press training on increasing arm and chest muscle strength in novice visitors to the FKIP Undana Physical Education and Training Center (Penjaskesrek Fitness), the following conclusion can be drawn: There is a significant effect of bench press training on increasing arm muscle strength (1RM and handgrip) and chest muscle strength (chest circumference). This is demonstrated by the Wilcoxon Signed Rank Test, which shows an Asymp. Sig. (2-tailed) value of 0.000, indicating a significance value less than 0.05 ($p < 0.05$).

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