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EXTENDED ABSTRACT

Short-Term Effects of Bench Press Training on Muscle Hypertrophy and Strength in Untrained Males

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I. Introduction

Resistance training produces significant physical and muscle changes that improve strength, functional ability, and hypertrophy of skeletal muscles. The bench press, a popular multi-joint upper-body exercise targeting the pectoralis major, anterior deltoids, and triceps brachii, has been extensively studied for long-term adaptations, but limited knowledge exists about early-phase hypertrophic and strength responses in untrained males [1]. Traditional models suggest that initial strength gains (4-6 weeks) are primarily driven by neural mechanisms, while morphological changes develop subsequently. However, recent research challenges this paradigm, showing observable hypertrophy within the first weeks of training [2]. This study investigated the short-term effects of a four-week bench press training program on muscle hypertrophy and strength in untrained males, addressing critical gaps in understanding early-phase adaptations and the relationship between regional hypertrophy and strength gains.

II. Methods

A randomized pretest-post-test experimental design was employed with eight healthy, untrained males aged 18-24 years at Universiti Teknologi MARA. Participants had no structured resistance training experience within the previous 12 months. The intervention consisted of a four-week supervised bench press training protocol: three sessions per week at 75% of one-repetition maximum (1RM), performing three sets of ten repetitions with 2-3 minutes rest between sets. Muscle hypertrophy was assessed through pectoralis major and triceps brachii circumference measurements using standardized anthropometric techniques, and whole-body muscle mass via bioelectrical impedance analysis (BIA) using the Omron HBF-375 device. Strength was evaluated using standardized 1RM bench press testing at baseline, mid-intervention, and post-intervention. Data were analyzed using paired sample t-tests and Pearson correlation analysis, with significance set at $p \leq 0.05$.

III. Results and Discussion

A. Effects of Bench Press Training on Muscle Hypertrophy and Strength

Figure 1 illustrates a statistically significant improvement observed in 1RM bench press performance, with mean strength increasing from 42.9 ± 4.96 kg to 55.0 ± 5.00 kg (t = -13.678, $p < 0.001$), reflecting a large effect size (d = 5.17). This substantial gain in maximal strength aligns with early-phase neural adaptations typically observed in novice individuals undergoing resistance training [3]. These improvements are likely due to enhanced motor unit recruitment, synchronization, and firing rate, as commonly reported in the first few weeks of training [4]. Significant hypertrophy was also found in the pectoralis major (from 87.2 ± 5.50 cm to 90.2 ± 4.37 cm, t = -3.440, p = 0.014, d = 1.30) and triceps brachii (from 27.9 ± 2.59 cm to 30.0 ± 1.87 cm, t = -6.200, $p < 0.001$, d = 2.34). These changes reflect the primary involvement of these muscles in the bench press movement, emphasizing the exercise's specificity in targeting pushing musculature [5]. The large effect sizes indicate meaningful hypertrophic changes even within a short time frame, demonstrating that untrained individuals are particularly responsive to resistance training stimuli. However, there was no significant change in overall muscle mass (from 37.6 ± 3.31 kg to 37.4 ± 3.05 kg, t = 0.795, p = 0.457, d = 0.30). This suggests that the hypertrophy was localized, likely restricted to the upper body pushing musculature, and not sufficient in magnitude or duration to reflect in whole-body mass metrics. Similar findings have been reported by [6], where short-term interventions often resulted in site-specific hypertrophy without significant alterations in overall lean mass.

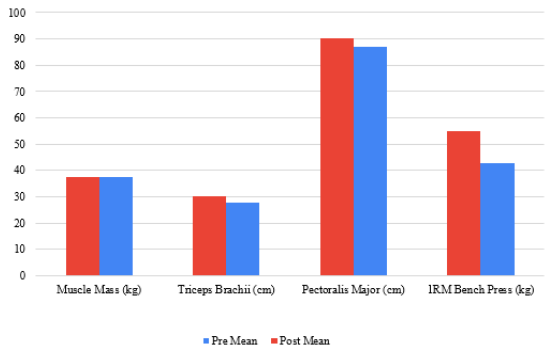

Fig. 1 Changes in muscle thickness of the triceps brachii, pectoralis major, and maximal (1-RM) strength during 4weeks of heavy bench press training.

B. Relationship Between Hypertrophy and Strength Gains

The analysis in Table I revealed weak, non-significant negative correlations for both PM circumference (r = -0.276, p = 0.549) and TB circumference (r = -0.236, p = 0.610). These findings indicate that increases in upper-body muscle size were not significantly associated with gains in bench press strength. This suggests that the observed strength improvements may have been driven more by neural adaptations than by morphological changes during the short training duration. Early-phase strength gains in novice lifters are typically attributed to enhanced motor unit recruitment, firing rate, and intramuscular coordination [4]. Additionally, the short duration of the program and small sample size (df = 5) may have limited the detection of meaningful associations. Previous research has noted that hypertrophy becomes a more dominant contributor to strength gains in later phases of training, while initial improvements are largely neural [7].

TABLE I
PEARSON CORRELATION

		PM Circumference	TB Circumference
		-0.276	-0.236
1RM	*df*	5	5
	p-value	0.549	0.610

IV. CONCLUSIONS

This study demonstrates that a four-week bench press training program at 75% 1RM effectively enhances upper-body strength and induces regional hypertrophy in untrained males. The findings support the dual-pathway model of adaptation, with neural mechanisms dominating early strength improvements while morphological adaptations manifest rapidly at specific sites. The results provide evidence-based guidance for beginner programming, suggesting that even brief resistance training protocols can yield substantial functional and aesthetic benefits. Future research should employ larger samples, advanced imaging techniques, and longer intervention periods to further clarify the mechanisms underlying early-phase adaptations.

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