Musamus Journal of Physical Education and Sport (MJPES)
http://ejournal.unmus.ac.id/index.php/physical
Volume 8, No. 4, October 2026 , Pg. 1317-1321
DOI: 10.35724/mjpes.v8i4.7964

Effects of Dumbbell-Resisted Punch Drills on Jab-Straight Punching Speed in Muay Thai Athletes

Maela Dwi Rahayu[1], Hariadi[1], Rina Nopiana[1], Nopi Hariadi[1]*, Ijtihadi Sya'bani[1], Irwan Jayadi[1], L. Aldi Wira Putra[1]

[1]*Physical Education Study Program, Universitas Hamzanwadi, East Lombok, West Nusa Tenggara, Indonesia*

Corresponding author: nopihariadi@hamzanwadi.ac.id

Abstract

Objectives: This study examined whether six weeks of dumbbell-resisted punch drills improved jab-straight punching speed in Muay Thai athletes.

Materials and Methods: A one-group pretest-posttest design was used. Sixteen athletes aged 17-30 years were purposively selected from 25 active members of the Rinjani Muaythai Boxing Club, East Lombok. Participants completed 18 training sessions over six weeks (three sessions per week). The main exercise comprised four sets of 15-20 alternating jab-straight repetitions while holding a 1-kg dumbbell in each hand, with progressive increases in repetition number and intended movement speed. Punching performance was assessed as the best number of valid target contacts achieved across three 30-second trials. Data were analyzed using the Shapiro-Wilk test and a paired-samples t-test at $\alpha = .05$.

Results: Mean punch count increased from 72.94 ± 5.34 to 82.63 ± 4.90 contacts per 30 seconds, corresponding to a mean gain of 9.69 contacts (13.28%). The change was statistically significant, $t(15) = 14.90$, $p < .001$, 95% CI [8.30, 11.07], with a large standardized within-participant effect (Cohen's $dz = 3.73$).

Conclusions: A six-week program of light dumbbell-resisted, technique-specific punch drills was associated with a substantial improvement in repeated jab-straight punching speed. The method may be incorporated cautiously as a supplementary exercise, but controlled trials are required before the improvement can be attributed solely to the intervention.

Keywords: combat sports; dumbbell training; jab-straight; Muay Thai; punching frequency

Introduction

Muay Thai is a striking combat sport in which athletes integrate punches, kicks, knees, and elbows under substantial temporal and physiological demands. Effective performance therefore depends not only on conditioning but also on the rapid and coordinated execution of sport-specific techniques. In straight punching, hand velocity, contact velocity, force transfer, and the timing of lower- and upper-body actions distinguish higher-level from less-skilled performers (Liu et al., 2022). Biomechanical work also shows that straight punches depend on coordinated force transmission through the kinetic chain rather than isolated arm action (Adamec et al., 2021; Kacprzak et al., 2025).

The jab and straight are central to distance control, combination building, and disruption of an opponent's attack. Because the lead hand can attain high velocity while the rear hand can contribute greater force, repeated jab-straight combinations require both technical efficiency and the ability to reproduce rapid actions (Liu et al., 2022; Mosler et al., 2024a). The frequency of valid strikes within a fixed interval is consequently a useful field indicator of repeated punching speed, although it does not directly quantify hand velocity or impact force. Instrumented studies have distinguished these constructs and emphasize the need to describe precisely what a punching test measures (Chadli et al., 2014; Menzel et al., 2021).

Resistance training can improve combat-sport fitness, but transfer depends on the relationship between the training stimulus and the target action. Movement pattern, contraction intent, load, and velocity all influence adaptation. The velocity-specificity literature indicates that adaptations tend to be greatest near the trained velocity and that an explosive movement intention may be especially important (Kawamori & Newton, 2006). Progressive loading is likewise required to maintain an effective stimulus while controlling technique and fatigue (American College of Sports Medicine, 2009). Recent boxing studies report improvements in punch-related outcomes after variable-resistance, velocity-based, and integrative neuromuscular programs, although their exercises, samples, and outcome measures differ (Han et al., 2026; Zhang et al., 2026; Liu et al., 2024).

Light dumbbells permit a punch-like movement to be rehearsed against modest external resistance. When drills are repeated with technical feedback and an intent to move rapidly, they may improve coordination,

Musamus Journal of Physical Education and Sport (MJPES)
http://ejournal.unmus.ac.id/index.php/physical
Volume 8, No. 4, October 2026 , Pg. 1317-1321
DOI: 10.35724/mjpes.v8i4.7964

movement economy, and the capacity to express force quickly. Evidence from technique-training research also suggests that repeated practice supported by performance feedback can enhance straight-punch quality (Khasanshin & Osipov, 2021). Nevertheless, excessive hand-held loading may alter technique, slow the action, or increase shoulder and elbow stress. The load and volume must therefore remain conservative, and unresisted technical practice should remain the foundation of training.

At the Rinjani Muaythai Boxing Club in East Lombok, coaches observed that some athletes could initiate combinations effectively but lost speed during subsequent punches. A preliminary 30-second test produced a mean of 72.94 valid contacts, suggesting room for improvement in repeated jab-straight execution. Prior local studies have reported positive changes after dumbbell-based punching practice (Ardhiarto & Putra, 2025; Rahmat et al., 2024), but evidence specific to a progressive drill program in this setting remains limited. Accordingly, this study aimed to determine whether six weeks of light dumbbell-resisted punch drills were associated with improved jab-straight punching speed among club-level Muay Thai athletes. It was hypothesized that posttest punch counts would exceed pretest values.

Materials and Methods

Study Design

This quantitative study used a one-group pretest-posttest design. All participants completed the same baseline test, six-week intervention, and post-intervention test. The design was selected because the available athletes followed one club training schedule and could not be allocated to separate groups. Because no control group was included, the design estimates within-participant change but does not by itself establish that the intervention caused the change.

Study Participants

The study population comprised 25 athletes registered at the Rinjani Muaythai Boxing Club, East Lombok, West Nusa Tenggara, Indonesia. Purposive sampling yielded 16 participants who (a) were active club members, (b) were 17-30 years old, (c) attended training regularly, and (d) were free from injury during the study. The source manuscript did not report sex distribution, anthropometric characteristics, competitive level, or training experience; these details should be added before submission because they affect interpretation and reproducibility.

Study Organization

Data collection took place from 22 January to 7 March 2026. The program comprised 18 intervention sessions scheduled on Mondays, Thursdays, and Sundays, plus one pretest and one posttest session (20 study contacts in total). Each intervention session lasted approximately 30-45 minutes. Participants held a 1-kg dumbbell in each hand and performed four sets of 15-20 jab-straight repetitions, with 60 seconds of recovery between sets. Repetitions and intended movement speed were increased every two weeks in accordance with progressive-overload principles. Coaches monitored technique throughout the drills. The source manuscript did not specify whether normal club training was standardized; this is acknowledged as a potential co-intervention.

Punching performance was assessed using a heavy bag positioned with its target center approximately 120 cm above the floor. Each athlete began about 70 cm from the bag and, after a verbal signal, performed alternating straight punches for 30 seconds while wearing boxing gloves. A contact was scored when the glove struck the designated target; missed or off-target punches were excluded. Each athlete completed three trials separated by 30 seconds, and the highest valid-contact count was retained. The same bag, distance, timing procedure, camera, assessors, and instructions were used at pretest and posttest. This outcome represents repeated valid-punch frequency, not instrumented fist velocity or impact force.

Statistical Analysis

Descriptive statistics included the mean, standard deviation, minimum, maximum, mean change, and percentage change. Normality of pretest and posttest scores was assessed using the Shapiro-Wilk test. A two-tailed paired-samples t-test compared pretest and posttest values at $\alpha = .05$. The mean difference was reported with a 95% confidence interval, and Cohen's dz was calculated as the mean paired difference divided by the standard deviation of the paired differences. Analyses were conducted in SPSS. Exact p values are reported except when $p < .001$.

Results

Musamus Journal of Physical Education and Sport (MJPES)
http://ejournal.unmus.ac.id/index.php/physical
Volume 8, No. 4, October 2026 , Pg. 1317-1321
DOI: 10.35724/mjpes.v8i4.7964

All 16 participants had complete pretest and posttest data. Every athlete recorded a higher posttest score. Pretest values ranged from 64 to 80 valid contacts, whereas posttest values ranged from 75 to 90. The mean increased by 9.69 contacts per 30 seconds, equivalent to 13.28% of the pretest mean (Table 1).

Table 1. Descriptive statistics for jab-straight punching performance (n = 16)

Measurement	Mean	SD	Minimum	Maximum	Mean change	Change (%)
Pretest	72.94	5.34	64	80	—	—
Posttest	82.63	4.90	75	90	9.69	13.28

Shapiro-Wilk tests did not reject normality for either measurement (Table 2). The paired-samples t-test showed that posttest scores were significantly higher than pretest scores, $t(15) = 14.90$, $p < .001$. The 95% confidence interval indicated an estimated mean improvement of 8.30-11.07 valid contacts. Cohen's dz was 3.73, indicating a very large standardized within-participant change (Table 3).

Table 2. Shapiro-Wilk normality tests

Measurement	W	df	p
Pretest	.906	16	.100
Posttest	.945	16	.420

Table 3. Paired-samples comparison of pretest and posttest performance

Contrast	Mean difference	SD difference	95% CI	t	df	p	Cohen's dz
Posttest − pretest	9.687	2.600	[8.302, 11.073]	14.901	15	< .001	3.73

Discussion

The principal finding was a 13.28% increase in repeated valid jab-straight contacts after six weeks of light dumbbell-resisted punch drills. The large paired effect and confidence interval indicate that the observed change was both statistically clear and practically substantial within this sample. However, the absence of a control group means that the result should be interpreted as an association with the training period rather than definitive evidence of an intervention effect.

The improvement is consistent with the principle of task specificity. The drills retained the general direction and sequencing of the jab-straight action while adding a small external load and emphasizing rapid execution. Such practice may have strengthened coordination between the shoulder, elbow, trunk, and lower-body contributions needed to repeat straight punches efficiently. This explanation agrees with biomechanical findings showing that punch performance is determined by coordinated segmental action and force transmission rather than arm strength alone (Adamec et al., 2021; Liu et al., 2022; Stewart et al., 2025). It also accords with velocity-specific resistance-training theory, which emphasizes both movement velocity and the intention to accelerate (Kawamori & Newton, 2006).

The present result also converges with emerging intervention evidence. Variable-resistance complex training has improved punch performance in elite amateur boxers (Liu et al., 2024), while integrative neuromuscular training has produced gains in single and repeated punching outcomes (Zhang et al., 2026). Velocity-based resistance programming likewise appears capable of improving boxing-specific performance when fatigue is managed through velocity-loss thresholds (Han et al., 2026). Although those programs differ from the current dumbbell drill, together they suggest that appropriately dosed strength, speed, and coordination stimuli can transfer to punching performance.

Technique repetition may have contributed independently of the dumbbell load. Khasanshin and Osipov (2021) found that repeated straight-punch practice paired with real-time feedback improved punch quality, underscoring the importance of movement calibration and feedback. Thus, the current gain may reflect combined effects of resistance exposure, repeated technical practice, familiarization with the test, and ordinary club training. A future trial should compare at least three conditions: dumbbell-resisted drills, volume-matched unresisted drills, and normal training. Such a design would separate the contribution of added resistance from the contribution of practice itself.

From a practical perspective, the protocol is simple and inexpensive: three weekly sessions, a 1-kg load in each hand, four sets, and controlled progression. Coaches should nevertheless prioritize technical integrity. Punching with handheld loads can change acceleration and joint loading; heavier loads or fatigued execution may reinforce a slower or altered motor pattern. The resisted drill is therefore best used as a supplementary exercise in short, supervised sets, followed by unresisted practice at competition-relevant speed. Athlete age, training status, shoulder health, and technical proficiency should guide individual prescription.

Several limitations qualify the findings. First, the one-group design is vulnerable to history, maturation, testing, expectancy, and concurrent-training effects. Second, the small sample came from one club, limiting generalizability. Third, the best of three 30-second trials was analyzed; reliability coefficients for the exact protocol and assessor agreement were not reported. Fourth, punch count does not directly measure fist velocity, impact force, accuracy beyond the target criterion, or technical quality. Fifth, participant sex, anthropometry, competitive experience, adherence, adverse events, and load progression by session were not reported in the source data. Future research should preregister a randomized controlled design, report test-retest reliability, standardize co-interventions, monitor adverse events and attendance, and combine punch frequency with instrumented velocity and force measures.

Conclusions

Six weeks of progressive, light dumbbell-resisted jab-straight drills were associated with a significant and substantial increase in repeated valid punching performance among 16 Muay Thai athletes. Mean performance improved from 72.94 to 82.63 contacts per 30 seconds. The protocol may be considered a practical supplementary training option when loads are light and technique is supervised. Because the study lacked a control group and used a small single-club sample, controlled research is required before concluding that the dumbbell component alone caused the improvement.

Acknowledgments

The authors thank the athletes and coaching staff of the Rinjani Muaythai Boxing Club for their participation and assistance.

Conflict of Interest

The authors declare no conflict of interest.

Funding

This research received no external funding.

References

Adamec, J., Hofer, P., Pittner, S., Monticelli, F., Graw, M., & Schöpfer, J. (2021). Biomechanical assessment of various punching techniques. International Journal of Legal Medicine, 135, 853–859. https://doi.org/10.1007/s00414-020-02440-8

American College of Sports Medicine. (2009). American College of Sports Medicine position stand: Progression models in resistance training for healthy adults. Medicine & Science in Sports & Exercise, 41(3), 687–708. https://doi.org/10.1249/MSS.0b013e3181915670

Ardhiarto, B. U., & Putra, R. B. A. (2025). Pengaruh latihan repetisi maksimal resistance band dan beban dumbbell untuk meningkatkan kecepatan pukulan straight anggota tinju laki-laki Olympus Fight Club Kota Semarang. Indonesian Journal for Physical Education and Sport, 6(1), 121–130. https://doi.org/10.15294/inapes.v6i1.22306

Chadli, S., Ababou, N., & Ababou, A. (2014). A new instrument for punch analysis in boxing. Procedia Engineering, 72, 411–416. https://doi.org/10.1016/j.proeng.2014.06.073

Han, Y., et al. (2026). Effects of in-season velocity-based resistance training on boxing-specific performance in collegiate boxers. Journal of Functional Morphology and Kinesiology, 11(3), 310. https://doi.org/10.3390/jfmk11030310

Kacprzak, J., Mosler, D., Tsos, A., & Wąsik, J. (2025). Biomechanics of punching—The impact of effective mass and force transfer on strike performance. Applied Sciences, 15(7), 4008. https://doi.org/10.3390/app15074008

Kawamori, N., & Newton, R. U. (2006). Velocity specificity of resistance training: Actual movement velocity versus intention to move explosively. Strength and Conditioning Journal, 28(2), 86–91. https://doi.org/10.1519/1533-4295(2006)028[0086:VSORTA]2.0.CO;2

Khasanshin, I., & Osipov, A. (2021). Using an artificial neural network to develop an optimal model of straight punch in boxing and training in punch techniques based on this model and real-time feedback. PLOS ONE, 16(11), e0259457. https://doi.org/10.1371/journal.pone.0259457

Liu, Y., Zhu, Z., Chen, X., Deng, C., Ma, X., & Zhao, B. (2022). Biomechanics of the lead straight punch of different level boxers. Frontiers in Physiology, 13, 1015154. https://doi.org/10.3389/fphys.2022.1015154

Menzel, T., et al. (2021). Validation of a unique boxing monitoring system. Sensors, 21(21), 6947. https://doi.org/10.3390/s21216947

Mosler, D., et al. (2024a). Higher values of force and acceleration in rear cross compared to lead jab in trained boxers. Applied Sciences, 14(7), 2830. https://doi.org/10.3390/app14072830

Musamus Journal of Physical Education and Sport (MJPES)
http://ejournal.unmus.ac.id/index.php/physical
Volume 8, No. 4, October 2026 , Pg. 1317-1321
DOI: 10.35724/mjpes.v8i4.7964

Mosler, D., et al. (2024b). The influence of effective mass on the striking force in boxing. Applied Sciences, 14(17), 7785. https://doi.org/10.3390/app14177785

Pinto, M., et al. (2025). Influence of anthropometric characteristics and muscle strength on punching performance in boxers. Sports, 13(8), 281. https://doi.org/10.3390/sports13080281

Rahmat, Z., Irfandi, I., & Munzir, M. (2024). The effect of dumbbell load training on straight punch speed in Muay Thai athletes. Journal Coaching Education Sports, 3(1), 97–104. https://doi.org/10.31599/key0j337

Rinaldi, M., et al. (2018). Biomechanical characterization of the Junzuki karate punch: Indexes of performance. European Journal of Sport Science, 18(6), 796–805. https://doi.org/10.1080/17461391.2018.1455899

Stewart, C., et al. (2025). The role of lower limb kinetics in boxing punches and the impact of fatigue. Bioengineering, 12(12), 1355. https://doi.org/10.3390/bioengineering12121355

Zhang, L., Li, H., Wei, Q., Xiao, Y., & Gao, Q. (2026). The effect of integrative neuromuscular training on physical fitness and punching performance in highly-trained male boxers. Frontiers in Physiology, 17, 1810393. https://doi.org/10.3389/fphys.2026.1810393

Liu, Y., Huang, Z., Zhou, Z., Zhang, L., Guo, Y., & Chen, C. (2024). Effects of variable resistance training within complex training on physical fitness and punch performance in elite amateur boxers. Frontiers in Physiology, 15, 1472258. https://doi.org/10.3389/fphys.2024.1472258