

The effect of front squats on the net ability of junior weightlifters

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ABSTRACT

Problem: Athletes sometimes have trouble performing the final position of the Clean, this error generally occurs when standing to complete the Clean. This happens due to the lack of strength of the main muscles involved in the Clean technique, observed directly when athletes perform the Clean Exercise program, among which there are those who do not succeed in doing the final position of Clean, that is, standing perfectly with the barbell position still on the shoulder. Therefore, to overcome these problems, supportive exercises are carried out to strengthen the main muscles involved in the clean technique, namely the Front Squat. **Objective:** To prove that the Front Squat exercise has an effect on the improvement of the main muscles that play a role in Clean. **Methods:** This research method is a Quantitative Experimental research with a Paired Sample T test research design. The instruments used are Pre-test and Post-test. Using the Jamovi statistical test. **Results:** The results of the *paired sample t-test* showed a significant increase in score from pre-test to post-test, $t(11) = -10.70, p < 0.001$. The mean score difference was -3.08 (SE = 0.288) with a 95% confidence interval between -3.72 to -2.45 . A measure of the *Cohen effect d* of -3.10 suggests that the intervention has a very large effect. **Conclusion:** Based on the results of a study that has been conducted for four weeks by providing Front Squat gymnastics twice every week, it can be concluded that Front Squat exercises have a significant influence on the improvement of Clean ability in Jambi City Junior Weightlifters in Jambi City. The results of the t-test analysis of paired samples showed a significant increase between pre-test and post-test values, $t(11) = -10.70, p < 0.001$, with an average score difference of -3.08 . The enormous effect size (Cohen's $d = -3.10$) confirms that the Front Squat has a strong impact on improving the strength and performance of the Clean technique.

Keywords: weightlifting, clean, front squat, junior.

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Introduction

Weightlifting is a sport that is played with great power and speed techniques to control the load. Specialized sports that require high technique, explosiveness, and flexibility (Khuyagbaatar et al., 2024). Weightlifting is mostly done with high frequency, very high intensity and every movement is done at high speed in a very short time (Hanaf & Hermawan, 2025). Weightlifting is classified into catching exercises that include the barbell catching phase and the pull exercise that eliminates the catching phase, resulting in more strength. However, because only external loads are projected in Weightlifting, athletes hardly leave the platform. Therefore it is considered a semiballistic exercise (Takei et al., 2024). As well as being included in competitive sports with high external loads (Skaug et al., 2020) and the victory is determined from the highest cumulative weight successfully lifted (Joffe et al., 2025). A common training method used to increase strength and strength, with a growing interest in its application among young athletes (Morris, 2025).

Weightlifting has a very important basic technique, which is Clean, which is the main prefix of the Clean and Jerk type of style. Clean: This is done by lifting the weight from the platform to the front shoulder in a 90-degree elbow position and done with one explosive motion. Use shoulder-width grips to make the torso more vertical (Ammar et al., 2018) and high-amplitude movements in the leg muscles (Kruszewski et al., 2022). The strength of dynamic and static contractions in the legs is strongly associated with

anaerobic performance (Vural et al., 2023) Clean, Clean really needs the strength of the leg muscles (lower extremities) such as the quads, buttocks, hamstrings and Erector Spinae which act as isometric stability to stay in the correct position. Clean's movement pattern is influenced by the weight of the barbell and the strength of the leg muscles (Werner et al., 2021). Athletes need strong, sturdy leg muscles in order to produce perfect and successful strength (Jatmiko et al., 2024). Muscle strength is a major factor that determines the performance of dynamic sports where athletes exert large amounts of force in a short period of time, the ability to exert a high level of muscle strength is an important component to improve performance. The importance of muscle strength should not be underestimated. Strength also plays an important role in protecting athletes from potential injury (Saputra, 2023). Strength is the ability to generate force against external resistance, its application dynamically providing a mechanism for moving. (Stone et al., 2024). Because of its relationship to movement, strength is an integral aspect that underlies ability. Performance Therefore, athletes should focus on increasing power output in the lower extremities. To catch a successful one in the Clean, the barbell must reach a minimum vertical displacement, allowing the lifter enough time to fall under it (Sandau et al., 2021). The displacement of the barbell is determined by the impulse (force x time) applied to the platform, relative to the mass of the system (body mass x mass of the rod) during the pull phase. The pull phase occurs from the moment the barbell breaks contact with the platform to the maximum extension angle of the knee end, but is further divided into 3 sub-phases; first pull, transition, and second pull (Chavda et al., 2021). The muscles that are interconnected and have an important role in weightlifting are the leg muscles (Sholehah, 2020). Strong leg thrust and proper coordination with the hips are essential to produce maximum strength Bersih (Purba et al., 2024) Affected by the weight of the barbell, especially the higher height compared to the previous bar and the deeper squat position accompanied by a wider standing position, and the arms are less high and change the posture, especially in the change phase. Shows that moving under the barbell as quickly as possible has high relevance in technique training (Inge Werner et al., 2021)

Junior weightlifting in Jambi City has the potential to be developed. In juniors, athletes are in a golden period of skill development (Aini et al., t.t.). However, athletes often have difficulty in reaching the final position *Clean*, a common mistake that often occurs is a lack of explosive power so that it is hampered in the position while standing. This happens due to the lack of the main muscle strength involved in the Clean. Therefore, it is necessary to train the strength of the legs and core muscles, one of the exercises that can be used to train the strength of the leg muscles and core muscles is the Squat exercise. The squat is a closed kinetic chain exercise, which involves a large multi-joint muscle mass, emphasizing the muscles of the upper and middle body, especially the erector spine (especially isometric) as well as the leg and hip extensors (dynamically) (Stone et al., 2024). Squatting exercises have a significant influence on increasing strength (Sartika & Rasyid, t.t.) without causing injury (Oshikawa et al., 2021a). Squats With external loads are a common part of resistance training programs designed to improve sports performance due to their ability to gradually put excess load on the muscles of the lower extremities and posterior trunk (Bautista et al., t.t.). The Squat variation used is the Front Squat Squat is very important for athletes who perform Cleans, as it trains the body position necessary for a successful catch and may be a biomechanically beneficial variation if the goal is to target the knee extensor muscles. ("Bilateral Barbell Squat Variations," 2023), where the barbell is positioned at the front of the Clavícula and Anterior Deltoid, this position is the same as receiving the barbell at Clean. Front Squat shows a smaller inclination of the anterior rod to avoid dropping the barbell held in front of the body (Oshikawa et al., 2021b). Front Squat has a great effect on Power Clean, Deltoid's previous muscle activity is higher during Front Squat

Therefore, this study focuses on how much the Front Squat affects the ability of Jambi City Clean Junior Weightlifters. This is shown from a direct review in the field. It is observed that Junior Athletes are often hampered to complete the Clean position, showing evidence seen directly when they are practicing, if the load is already heavy, some of them are in a hampered position to complete the clean ending, which leads to failure to reach the final position. To overcome this, it is necessary to improve performance through effective exercises, one of which is the Front Squat because the Front Squat movement resembles Clean. And also this exercise can increase the strength of the leg muscles. So the front squat has a significant influence in increasing the explosive power of the leg muscles (Ikhwan et al., 2023).

Method

This type of research is a Quantitative Experimental research. Quantitative research is defined as a research method based on the philosophy of positivism (considering that reality/phenomena can be classified, and the relationship of symptoms is cause and effect), used for research on certain populations or samples, data collection using research instruments, statistical data analysis with the aim of testing established hypotheses (Sugiyono, 2022). Quantitative experiments are defined as research methods used

to find the effects of treatment under controlled conditions (Sugiyono, 2022). This study uses a Paired Sample T-test test design with Pre-Test and Post-Test models. The population in this study was 12 Junior Weightlifters, who had been training for 1 year. Samples are part of the number and characteristics possessed by the population (Sugiyono, 2022). The sampling technique uses Saturated Sampling, this sample determination technique is taken from all populations (Sugiyono, 2022) so that the sample in this study is the same as the population, namely 12 people, with 8 women and 4 men who have practiced for 1 year. This research procedure lasted for 4 weeks, taking a pre-test of 1RM Clean, after which the Front Squat was given treatment by adding weight, frequency, and reps to the Front Squat. Athletes do Front Squats 2 times in 1 week. In week 4, a Clean post-test was taken, and after obtaining the results of the Pre-test and Post-test, it was statistically tested using the analysis of Jamovi with Paired Sample T-test, to see the comparison of the results of the Pre-test and Post-test Clean.

Results

From the results of the study for 4 weeks with 2 times a week doing Front Squats with a total of 8 Front Squats, the results listed in the table were obtained

Table 1. Pre-test and Post-test 1RM Net

Yes	Name	Pre-tests	Posts – tests
1	I	50 kg	52 kg
2	Ri	55 kg	60 kg
3	and	66 kg	68 kg
4	Va	67 kg	70 kg
5	Uf	73 kg	77 kg
6	In	67 kg	70 kg
7	Fa	93 kg	96 kg
8	Fh	66 kg	68 kg
9	Ar	60 kg	64 kg
10	Back	50 kg	54 kg
11	Fa	68 kg	71 kg
12	Yes	110 kg	112 kg

Table 2. Statistical Test Results

Paired Sample T-Test													
95% Confidence Interval						95% Confidence Interval							
Pre-tests	Post-tests	T students	Statistics	Df	p	Average difference	DIFFERENCES	Lower	Top	Effect Size	Lower	Top	
			-10.7	11.00	<.001	-3.08	0,2	-3.72	- 2.45	D Cohen	-3.10	-4.48	- 1.69
Note. H _a μSize 1 – Size 2 ≠ 0													
Paired Sample T-Test													
95% Confidence Interval						95% Confidence Interval							
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The results of the paired sample t-test showed a significant increase in scores from pre-test to post-test, $t(11) = -10.70, p <.001$. The mean score difference was -3.08 (SE = 0.288) with a 95% confidence interval between -3.72 to -2.45. A measure of the Cohen effect *d* of -3.10 suggests that the intervention has a very large effect.

Table 3. Normality Test Results

Normality Test (Shapiro-Wilk)				
		W	p	
Pre-tests	-	Post-tests	0,609027778	0.080

Note. A low p-value indicates a violation of the assumption of normality

Based on the test results, only post-test data was available for analysis, with values $W = 0.609$ and $p = 0.080$. Since the p-value is greater than 0.05, the post-test data is declared to be normally distributed and is eligible for use in parametric statistical analysis.

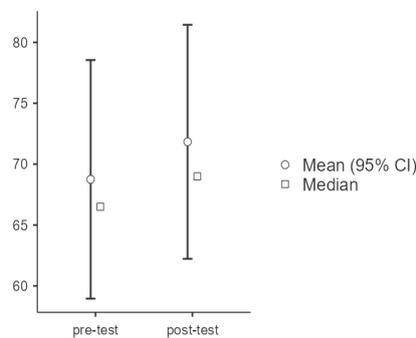


Figure 1. Plot

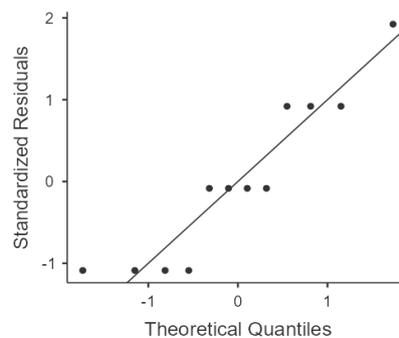


Figure 2. Q-Flow

Discussion

The Shapiro-Wilk normality test was performed to ensure the feasibility of using parametric analysis. The results showed that the post-test data were distributed normally ($W = 0.609$; $p = 0.080$), thus meeting the assumption to perform a *pair of sample t-tests*.

Paired t-test *analysis* was then used to test the difference between pre-test and post-test scores. The results showed significant improvement after treatment, with values of $t = -10.7$, $df = 11$, and $p < 0.001$. A mean difference of -3.08 (95% CI: -3.72 to -2.45) indicates that post-test scores are consistently higher than pre-tests.

The Cohen effect measure $d = -3.10$ suggests that the impact of treatment is enormous. The magnitude of this effect shows that the intervention provided has a strong influence on improving participants' abilities.

This study is designed to improve the ability of leg muscles through the treatment of Front Squat exercises. After data analysis, it was concluded that the hypotheses proposed in the study could be statistically proven and accepted to be empirically correct. So it is concluded that Front Squat gymnastics has an influence

on the increase of 1RM Clean of Junior Weightlifters. However, from the results that have been obtained, the increase in the amount of 1RM Clean is not the same, this can be influenced by other factors that trigger lifting, such as balanced nutrition in the form of supplements, especially foods that contain many protein elements that play an active role in increasing muscle strength. Get enough rest, after doing physical activity, of course, the body needs rest so that it can regenerate properly. Focusing on exercise, especially on the leg muscles, is indispensable to achieve maximum strength and also follow the exercise program properly and correctly. Because the front squat is very important in weightlifting, it requires certain conditions as capital in weightlifting, including adequate physical conditions in the form of strength and flexibility. Muscle strength is a major factor that determines sports performance (Hayashi et al., 2021). Train the thigh muscles heavier and more tiring. From the results of Anggrayni's research entitled *The Effect of Front Squat Training with a Set System on the Ability of the Clean and Jerk Force of Weightlifters in Padang City*, significant results were obtained, it was stated that Front Squat has an effect on increasing force in Clean and Jerk. So why is this study being researched again by the researchers, because they want to test different cities, whether the results obtained have the same influence because it can be seen from different geographical conditions so that the results obtained will also be different.

Conclusion

Based on the results of the research that has been carried out for four weeks by providing Front Squat exercises twice every week, it can be concluded that Front Squat gymnastics has an influence on the improvement of Clean ability in Junior Weightlifters in Jambi City. The results of the t-test analysis of paired samples showed a significant increase between pre-test and post-test values, $t(11) = -10.70$, $p < 0.001$, with an average score difference of -3.08 . The enormous effect size (Cohen's $d = -3.10$) confirms that the Front Squat has a strong impact in improving the strength and performance of the Clean technique.

Thus, the Front Squat proves to be an effective form of exercise to improve leg strength and body stability which contributes directly to the success of the Clean technique for junior athletes. This exercise is recommended as an important part of a weightlifting athlete coaching program, especially for beginner athletes who still have difficulty in the stability and explosiveness of movement.

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