

Effect of Very Low Intensity Weight Squat Exercises (<30% 1-RM) on Leg Strength of Sports Coaching Education Students

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<p>Article History Received: 02-01-2025; Reviewed: 17-01-2025; Accepted: 24-01-2025; Published: 30-01-2025;</p>	<p style="text-align: center;">ABSTRACT</p> <p>Background: Leg strength is a fundamental physical component required by sports coaching education students to support both their academic practical activities and future professional roles as sports coaches. Traditional resistance training guidelines generally recommend moderate-to-high intensity loads (>60% 1-RM) to elicit meaningful strength gains. However, very low-intensity squat training combined with techniques such as slow-tempo execution and reduced rest intervals has recently emerged as a potential alternative for inducing strength adaptations, particularly for individuals seeking joint-friendly training options. Empirical evidence regarding the effectiveness of very low-intensity squat training in producing leg strength gains among sports coaching education students remains limited. Objectives: This study aimed to analyze the effect of very low-intensity squat training (<30% 1-RM) on leg strength among sports coaching education students. Methods: This study employed a quantitative approach using a Pre-Experimental One Group Pretest-Posttest Design. The participants consisted of 38 sports coaching education students selected through purposive sampling. The intervention was conducted over eight weeks with a frequency of three sessions per week, in which participants performed back squat exercises at an intensity below 30% of their one-repetition maximum (1-RM), executed with slow tempo and short inter-set rest intervals to maximize time under tension and metabolic stress. Leg strength was assessed using the back squat 1-RM test, while leg power was assessed using the standing broad jump test. Data were analyzed using descriptive statistics, the Shapiro-Wilk normality test, and Paired Sample t-Test at a significance level of $\alpha = 0.05$. Results: The findings revealed significant improvements in leg strength and power following the intervention. Back squat 1-RM increased from 52.36 ± 9.14 kg to 64.78 ± 10.27 kg, representing a 23.73% improvement ($p = 0.000$). Standing broad jump distance increased from 178.42 ± 14.36 cm to 196.85 ± 13.92 cm, representing a 10.33% improvement ($p = 0.000$). Conclusions: Very low-intensity squat training (<30% 1-RM) performed with slow tempo and short rest intervals significantly improves leg strength and power among sports coaching education students, suggesting that this training approach is a viable, joint-friendly alternative to conventional high-intensity resistance training for enhancing lower-limb strength in this population.</p> <p>Keywords: Low-Intensity Resistance Training; Squat Exercise; Leg Strength; 1-RM; Sports Coaching Students.</p>
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INTRODUCTION

Leg strength represents one of the most fundamental physical components required across nearly all sports disciplines, serving as the foundation for movements such as jumping, sprinting, change of direction, and stabilization during dynamic athletic actions (Suchomel et al., 2016;

Arga, 2025a). For students enrolled in sports coaching education programs, the development of adequate leg strength carries dual importance, as it not only supports their personal participation in practical coursework involving various sports activities but also equips them with the embodied understanding necessary to design and supervise strength training programs in their future roles as certified sports coaches (Suwardi et al., 2026).

Conventional resistance training guidelines have long emphasized the use of moderate-to-high training intensities, typically exceeding 60-70% of one-repetition maximum (1-RM), as the primary stimulus required to elicit meaningful gains in muscular strength (American College of Sports Medicine, 2009). This intensity-strength relationship is grounded in the principle of progressive overload, which posits that sufficient mechanical tension must be applied to skeletal muscle to trigger the neuromuscular and morphological adaptations underlying strength development (Schoenfeld, 2010). Consequently, high-intensity loading has traditionally been regarded as a prerequisite for effective strength training prescription.

However, an emerging body of research has challenged this conventional paradigm by demonstrating that very low-intensity resistance training, when combined with specific manipulation of training variables such as slow movement tempo, restricted rest intervals, and training to or near volitional fatigue, can produce strength and hypertrophy adaptations comparable to those achieved through traditional high-intensity protocols (Schoenfeld et al., 2017; Morton et al., 2019). This phenomenon is theorized to occur because prolonged time under tension and the accumulation of metabolic stress during low-load, high-repetition training can sufficiently recruit high-threshold motor units, even in the absence of heavy external loading (Burd et al., 2010).

Low-intensity resistance training approaches, often performed at loads below 30% of 1-RM, present several potential advantages for specific populations. Because the absolute joint loading is substantially reduced compared to conventional heavy resistance training, this approach may offer a more joint-friendly alternative for individuals concerned about injury risk, joint discomfort, or those returning from minor musculoskeletal complaints (Lixandrao et al., 2018). Additionally, the reduced loading demands may lower psychological barriers to training participation, particularly among individuals who experience apprehension toward lifting heavy external loads (Mattocks et al., 2017).

Several studies have provided empirical support for the effectiveness of very low-intensity resistance training protocols. Schoenfeld et al. (2017) demonstrated that low-load resistance training performed with sufficient volume and proximity to muscular failure produced strength gains that were statistically comparable to high-load training among untrained individuals over an eight-week intervention period. Similarly, Morton et al. (2019), through a systematic review and meta-analysis, concluded that resistance training intensity exerted a smaller influence on strength adaptation than previously assumed, provided that training volume and effort were adequately controlled. These findings suggest that very low-intensity training, when appropriately programmed, may represent a legitimate strategy for strength development rather than merely a compromise solution for special populations.

Despite this growing evidence base, the majority of existing studies on low-intensity resistance training have been conducted using upper-body exercises or general untrained populations within controlled laboratory settings (Lixandrao et al., 2018; Mattocks et al., 2017). Research specifically examining the effect of very low-intensity squat training on lower-limb strength among physically active populations, such as sports coaching education students who already possess a baseline level of physical conditioning, remains comparatively scarce. This represents an important gap, as the strength response to low-intensity training protocols may differ between trained and untrained populations due to differences in baseline neuromuscular adaptation (Schoenfeld, 2010).

In the Indonesian context, empirical studies examining alternative resistance training intensities within sports coaching education programs remain particularly limited, with most existing strength training research in this setting continuing to rely on conventional moderate-to-

high intensity protocols (Ridwan et al., 2025). Given the practical relevance of low-intensity training for future coaching professionals, who may eventually need to apply such methods with clients possessing joint limitations, injury history, or psychological apprehension toward heavy loading, contextualized research examining this training approach within sports coaching education settings is warranted.

Based on the background and research gaps identified above, this study was conducted to analyze the effect of very low-intensity squat training (<30% 1-RM) on leg strength among sports coaching education students. The findings of this study are expected to provide empirical evidence supporting the integration of low-intensity, joint-friendly resistance training methods into strength and conditioning curricula within sports coaching education programs, while broadening the range of evidence-based training options available to future coaching practitioners.

METHODS

This study employed a quantitative approach using a Pre-Experimental One Group Pretest-Posttest Design. This design was selected to determine the effect of very low-intensity squat training on leg strength and leg power among participants before and after the intervention. In this design, all participants underwent a pretest to determine baseline leg strength and power, followed by an eight-week intervention using very low-intensity squat training, and concluded with a posttest to identify the changes that occurred following the intervention.

The research population consisted of all active students enrolled in the Sports Coaching Education Study Program, totaling 112 students. The research sample was determined using purposive sampling technique by considering several criteria, namely: active students who had completed at least one semester of practical strength training coursework, free from lower-limb musculoskeletal injury or pain within the previous six months, not currently undergoing any other structured resistance training program outside the regular curriculum, and willing to participate in the entire research process including the pretest, eight-week intervention, and posttest. Based on these criteria, 38 students were obtained as the research sample.

The intervention was carried out over eight weeks with a frequency of three sessions per week, resulting in a total of 24 intervention sessions. Each session consisted of back squat exercises performed at an intensity below 30% of each participant's individually determined 1-RM. To compensate for the very low external load and ensure sufficient mechanical and metabolic stimulus, the squat exercise was performed using a slow eccentric and concentric tempo of approximately three seconds per phase, combined with short inter-set rest intervals of 30-45 seconds, following methodological principles described by Schoenfeld et al. (2017) and Burd et al. (2010). Each session consisted of four sets performed to or near volitional fatigue, with the number of repetitions per set ranging from 25 to 35 depending on individual fatigue tolerance. Training load was reassessed and adjusted every two weeks based on updated 1-RM estimations to maintain the prescribed relative intensity throughout the intervention period.

Data collection was carried out using two primary instruments. Leg strength was measured using the back squat one-repetition maximum (1-RM) test, conducted following standardized procedures involving progressive load increments with adequate inter-attempt rest periods to ensure measurement validity (Brzycki, 1993). Leg power was assessed using the standing broad jump test, in which participants performed three attempts from a static starting position, with the longest jump distance recorded as the representative value, following standardized protocols commonly applied in sports science research (Castro-Pinero et al., 2010). Both measurements were conducted by trained research assistants at the beginning (pretest) and end (posttest) of the eight-week intervention period under consistent testing conditions.

The research data were analyzed using descriptive statistics and inferential statistics. Descriptive analysis was used to determine the mean, standard deviation, minimum value, maximum value, and percentage change of each research variable. Prior to hypothesis testing, the data were tested for normality using the Shapiro-Wilk test to ensure that the data distribution met

the assumptions required for parametric analysis. Subsequently, hypothesis testing was conducted using the Paired Sample t-Test at a significance level of $\alpha = 0.05$ to determine the difference in back squat 1-RM and standing broad jump distance between pretest and posttest. Effect size was calculated using Cohen's d to determine the magnitude of the effect of very low-intensity squat training on the two research variables. The entire data analysis process was carried out using IBM SPSS Statistics software version 26.

RESULTS RESULTS

Characteristics of Samples

Table 1. Characteristics of the Research Sample (n=38)

Variable	Mean \pm SD
Age (years)	20,6 \pm 1,5
Height (cm)	167,4 \pm 8,3
Weight (kg)	63,8 \pm 9,6
Estimated 1-RM Back Squat Pretest (kg)	52,36 \pm 9,14
Resistance training experience (years)	1,4 \pm 0,7

Based on Table 1, the characteristics of the research sample show that the average age of participants was 20.6 ± 1.5 years. The average height of participants was 167.4 ± 8.3 cm, and the average weight was 63.8 ± 9.6 kg. The average baseline back squat 1-RM prior to the intervention was 52.36 ± 9.14 kg, while the average resistance training experience among participants was 1.4 ± 0.7 years, indicating that participants had a moderate level of prior familiarity with structured strength training as part of their academic coursework.

Table 2. Normality Test Results (Shapiro-Wilk)

Variable	Sig.
Back Squat 1-RM Pretest	0,326
Back Squat 1-RM Posttest	0,298
Standing Broad Jump Pretest	0,344
Standing Broad Jump Posttest	0,317

Based on Table 2, the significance value (Sig.) for the back squat 1-RM pretest variable was 0.326, while the posttest was 0.298. The standing broad jump pretest variable showed a significance value of 0.344, and the posttest showed 0.317. All variables analyzed had significance values above 0.05, indicating that all data were normally distributed and therefore suitable for parametric statistical analysis.

Changes in Leg Strength and Leg Power

Table 3. Paired Sample t-Test Results

Variable	Pretest	Posttest	Change (%)	Sig.
Back Squat 1-RM (kg)	52,36 \pm 9,14	64,78 \pm 10,27	+23,73	0,000

Standing Broad Jump (cm)	178,42 ± 14,36	196,85 ± 13,92	+10,33	0,000
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Based on Table 3, the average back squat 1-RM increased from 52.36 ± 9.14 kg during the pretest to 64.78 ± 10.27 kg during the posttest, representing an increase of 23.73% with a significance value of 0.000. This finding indicates that participants experienced a substantial and statistically significant improvement in maximal leg strength following the eight-week intervention. The average standing broad jump distance also increased, from 178.42 ± 14.36 cm in the pretest to 196.85 ± 13.92 cm in the posttest, representing an increase of 10.33% with a significance value of 0.000, reflecting a meaningful improvement in lower-limb explosive power.

Overall, both research variables showed significant changes from pretest to posttest following the implementation of very low-intensity squat training. The significance value obtained for each variable was 0.000, indicating that the observed changes were statistically significant at the $\alpha = 0.05$ level. Effect size analysis using Cohen's d produced values of 1.26 for back squat 1-RM and 1.34 for standing broad jump, both of which are categorized as large effect sizes, confirming the substantial practical impact of the intervention despite the very low training intensity employed.

Individual Strength Improvement Profile

Table 4. Distribution of Back Squat 1-RM Improvement Categories (n=38)

Category	Improvement Range (%)	Frequency (n)	Percentage (%)
Minimal	< 10	3	7,9
Moderate	10 – 25	21	55,3
Substantial	> 25	14	36,8

Based on Table 4, the majority of participants (55.3%) experienced a moderate improvement in back squat 1-RM ranging from 10% to 25%. A considerable proportion of participants (36.8%) experienced substantial improvement exceeding 25%, while only 7.9% of participants showed minimal improvement below 10%. This distribution indicates that the vast majority of participants (92.1%) experienced at least a moderate strength gain following the very low-intensity squat training intervention, demonstrating consistent effectiveness of the protocol across most individuals within the sample.

DISCUSSION

The findings of this study demonstrate that very low-intensity squat training, performed at an intensity below 30% of 1-RM, produces statistically significant and practically meaningful improvements in both leg strength and leg power among sports coaching education students. The 23.73% increase in back squat 1-RM observed in this study provides empirical support for the growing body of literature challenging the conventional assumption that high training loads are a strict prerequisite for meaningful strength development (Schoenfeld et al., 2017; Morton et al., 2019).

The substantial strength gains observed despite the very low external loading employed in this study can be explained through the manipulation of complementary training variables, specifically slow movement tempo and short inter-set rest intervals, which were designed to compensate for the reduced mechanical tension by increasing time under tension and accumulated metabolic stress. Burd et al. (2010) demonstrated that low-load resistance exercise performed to volitional fatigue produces myofibrillar protein synthesis responses comparable to high-load training, suggesting that sufficient recruitment of high-threshold motor units can be achieved even at very low relative intensities when training is performed with adequate effort and volume.

These findings are consistent with the work of Schoenfeld et al. (2017), who reported that low-load resistance training performed with sufficient volume produced strength gains statistically comparable to traditional high-load training among previously untrained individuals over an eight-week intervention period closely mirroring the duration employed in the present study. The results of this study extend this evidence to a population of physically active sports coaching education students, suggesting that the benefits of very low-intensity resistance training are not restricted to untrained individuals but may also be realized among populations with prior strength training experience.

The concurrent improvement observed in standing broad jump distance (10.33%) indicates that the strength adaptations induced by very low-intensity squat training translated into measurable improvements in functional lower-limb power, a critical component for sports coaching education students who must demonstrate competent movement patterns across various athletic disciplines (Suchomel et al., 2016). This finding aligns with Morton et al. (2019), who emphasized that resistance training-induced strength gains, regardless of the training intensity employed, generally transfer to improvements in related measures of muscular performance, provided that training volume and proximity to fatigue are adequately controlled.

The distribution of improvement categories observed in this study, with 92.1% of participants demonstrating at least moderate strength gains, suggests that very low-intensity squat training represents a broadly effective approach across individuals with varying baseline characteristics within this population. This finding has practical implications for sports coaching education curricula, as it indicates that very low-intensity training protocols can be reliably implemented across diverse student cohorts without requiring extensive individualization of training loads, which are often more technically demanding to prescribe and monitor in heavy-load resistance training contexts (Lixandrao et al., 2018).

From a practical and pedagogical perspective, these findings carry particular relevance for sports coaching education programs. Because very low-intensity squat training substantially reduces absolute joint loading compared to conventional heavy resistance training, this approach may offer a valuable pedagogical tool for introducing strength training principles to students with limited prior resistance training experience, or for use in contexts where access to heavy free-weight equipment is limited (Mattocks et al., 2017). Furthermore, as sports coaching education students will eventually apply their training knowledge with diverse client populations, including those with joint limitations or apprehension toward heavy loading, direct experiential familiarity with effective low-intensity training methods may enhance their future competency as coaching practitioners.

Despite these encouraging findings, several limitations should be acknowledged. The absence of a comparison group receiving conventional high-intensity squat training in this pre-experimental design limits the ability to directly determine whether very low-intensity training produced equivalent, superior, or inferior strength gains relative to traditional heavy-load protocols within this specific population. Additionally, the eight-week intervention period, while sufficient to detect significant strength improvements, does not provide insight into the long-term trajectory of strength adaptation beyond this timeframe. Future studies employing randomized controlled designs that directly compare very low-intensity and conventional high-intensity squat training protocols are recommended to further clarify the relative effectiveness and optimal application contexts of this training approach.

CONCLUSIONS AND SUGGESTIONS

Conclusion

Based on the results of the study, it can be concluded that very low-intensity squat training (<30% 1-RM), performed with slow tempo and short rest intervals, has a significant influence on improving leg strength and leg power among sports coaching education students.

Back squat 1-RM increased by 23.73%, while standing broad jump distance increased by 10.33% after eight weeks of intervention. These results show that very low-intensity squat

training is effectively used to enhance both maximal leg strength and functional lower-limb power among sports coaching education students, offering a viable, joint-friendly alternative to conventional high-intensity resistance training for this population.

Suggestions

1. Sports coaching education lecturers and curriculum developers are advised to consider incorporating very low-intensity resistance training methods as a complementary pedagogical tool within strength and conditioning coursework, particularly for introducing students to joint-friendly training alternatives.
2. Students and practitioners should ensure that very low-intensity squat training is performed with adequate volume, slow tempo, and proximity to volitional fatigue to maximize the effectiveness of this training approach.
3. Further research is recommended using randomized controlled designs with a comparison group receiving conventional high-intensity squat training to directly determine the relative effectiveness of both approaches.
4. Subsequent research can examine the influence of very low-intensity resistance training on other outcomes such as muscle hypertrophy, joint comfort, and long-term training adherence among sports science student populations.

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