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Comparative Effects of Standing and Squatting Pointing on Petanque Athletes' 7-Meter Skills

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Abstract

This study aimed to examine the effects of standing pointing and squatting pointing training on 7-meter pointing skills in Petanque athletes of Pelatda Mataram City in 2026. Petanque is a precision sport in which pointing accuracy plays a decisive role in scoring and tactical performance, so identifying effective training techniques is important for athlete development. The study employed a quantitative quasi-experimental approach with a within-subject repeated-measures design. Twelve active athletes were selected using total sampling and were tested under two training conditions, namely standing pointing and squatting pointing. Data were collected through a standardized 7-meter pointing skill test using a scoring-zone system, then analyzed descriptively and inferentially through the Shapiro–Wilk normality test, Levene's homogeneity test, and paired sample t-test, supported by effect size analysis using Cohen's d. The findings showed that both training techniques significantly improved pointing performance. In the standing pointing condition, the mean score increased from 16.50 to 21.50, with $t(11) = -9.319$, $p < 0.001$, and Cohen's $d = -2.690$. In the squatting pointing condition, the mean score increased from 15.67 to 22.42, with $t(11) = -7.745$, $p < 0.001$, and Cohen's $d = -2.236$. Although squatting pointing produced a greater mean increase, standing pointing demonstrated a stronger practical effect. In conclusion, both techniques were effective in improving 7-meter pointing skills, but standing pointing showed a more dominant overall effect and can be prioritized in technical training programs for Petanque athletes.

Keywords: Petanque, pointing skill, standing pointing, squatting pointing, training effect, accuracy, 7-meter distance.

INTRODUCTION

Petanque is one of the precision sports that continues to develop at the global and national levels. Globally, the development of Petanque is supported by the existence of international organizations and a standardized competition system, thus enabling cross-country participation and the development of athlete talents in a sustainable manner (Gusdillah & Makorohim, 2024; Suwanto et al., 2022). In Indonesia, this sport develops through the development of regional organizations, training coaches and referees, and the regular holding of championships in various provinces (Ardha et al., 2021; Irawan, Ghassani, et al., 2022; Jumadi et al., 2023). These developments show that Petanque is no longer seen only as a recreational sport, but also as an achievement sport that demands the scientific and systematic development of athletes' technique and performance.

In the context of the game, Petanque demands a high level of precision, especially in the pointing technique that is the basis of the game strategy. Pointing aims to place the iron ball as close as possible to the target ball (jack), to directly determine the chances of gaining points in the match (Jumadi et al., 2023; Wulandari & Jariono, 2023). Thus, the quality of the pointing technique not only affects the outcome of the throw, but also on the tactical decisions during the game. The success of pointing is influenced by various factors, both from the aspects of sensorimotor, biomechanics, and the physical condition of the athlete. Research shows that eye-hand coordination, concentration, and control of visual perception (quiet-eye) have an important role in improving throwing accuracy(Phytanza et al., 2022; Rhamadhan et al., 2023; Selva et al., 2023). In addition, physical factors such as arm muscle strength, wrist flexibility, and body balance also contribute to throwing

stability and accuracy (Sahariana et al., 2023; Syahwira et al., 2022).

One of the technical issues that is still interesting to study is the variation in body position used by athletes when pointing, especially standing positions and squatting positions. The two positions have different biomechanical characteristics, especially in terms of center of gravity, body stability, throw angle, and movement control. The standing position tends to provide a wider viewing angle and supports throwing mechanics at medium to long distances, while the squat position provides better stability because the body's center of gravity is lower (Helmi et al., 2024; Irawan, Ghassani, et al., 2022). These differences in characteristics suggest that the choice of body position likely affects the effectiveness of pointing, especially when athletes are required to maintain accuracy at a certain distance. However, there is no consistent conclusion as to which technique is more effective, especially at the 7-meter distance which is the medium distance and is often used in matches.

In general, the solution that is widely applied to improve pointing skills is through a systematic training program based on scientific principles. Task-specific training, carried out repeatedly (deliberate practice), and accompanied by appropriate feedback has been proven to be able to improve the accuracy of motor skills (Davies & Read, 2022; Jin, 2025). In the context of Petanque, a structured pointing training model also showed a significant improvement in athlete performance. In addition, exercises that integrate biomechanical aspects, such as release angles, gesture coordination, and posture stability, also play an important role in improving throwing accuracy (Helmi et al., 2024). However, the effectiveness of the exercise program is still greatly influenced by the form of technique trained, so the comparison between body positions is important to be examined empirically.

Furthermore, several previous studies have tried to examine the effectiveness of pointing techniques based on body position. A study by Irawan et al. (2022) shows that the standing pointing technique at a longer distance (about 9 meters) can produce good accuracy with a relatively small distance of the ball to the target. This indicates that the standing position provides an advantage in terms of body alignment and throw geometry. On the other hand, biomechanics approaches suggest that positions with a lower center of gravity, such as squatting, have the potential to improve stability and control of movement, thereby improving accuracy under certain conditions (Helmi et al., 2024). The findings suggest that each position has a strong theoretical basis, but it is not enough to explain which technique is more effective when tested directly at the same distance conditions.

In addition, other research emphasizes the importance of integration between biomechanical and perceptual aspects in pointing techniques. Movement control such as backswing, release angle, and coordination between the upper and lower bodies are important factors in determining the direction and speed of the ball (Irawan et al., 2022). In addition, cognitive factors such as concentration and visual strategies also affect the success of throws, especially in stressful competitive situations (Selva et al., 2023). Therefore, the evaluation of pointing techniques is not enough to only look at the result of the throw, but also to consider how the characteristics of the body position can support the integration of technical, physical, and cognitive aspects during movement.

Although various studies have examined the biomechanics and effectiveness aspects of pointing techniques, there is still a gap in research regarding direct comparisons between standing and squat pointing techniques, especially at medium distances such as 7 meters. Most studies focus more on one specific technique or at different distances, so it does not provide a comprehensive

picture of the effectiveness of the two techniques under the same conditions (Helmi et al., 2024; Irawan, Ghassani, et al., 2022). This gap is important because without direct comparison in the context of equivalent measurements, training recommendations given to coaches and athletes are at risk resting only on theoretical assumptions or partial findings. Therefore, experimental research that directly compares the two techniques is needed to produce stronger empirical evidence.

Based on this description, the purpose of this study is to analyze the effect of standing pointing and squat pointing exercises on 7-meter distance pointing skills in Petanque Pelatda athletes in Mataram City. Specifically, this study departs from the hypothesis that both exercise techniques can equally improve pointing skills, but the magnitude of the effect is thought to be different due to the differences in the postural and biomechanical characteristics of each position. This research is expected to make a scientific contribution in the form of empirical evidence regarding the effectiveness of the two techniques, as well as the basis for the development of a more optimal exercise program. The novelty of this research lies in the experimental comparative approach with within-subject design in the context of regional athletes, so that it can provide a more specific and applicable picture of the development of Petanque sports in Indonesia. The scope of the study was focused on the aspect of pointing skills, with the main variables in the form of body position (standing and squatting) and throwing accuracy at 7 meters.

METODE

Research Design

This study uses a quantitative approach with a quasi-experimental design based on within-subject repeated measures, namely each same subject undergoes two treatment conditions, namely standing pointing exercises and squat pointing exercises. This design was chosen because the main purpose of the study was to compare changes in motor skills in the same individual, so that variations between individuals could be suppressed and differences in results more reflect the influence of the techniques given. Methodologically, the within-subject approach is recommended to compare two motor skills techniques in the same subject because it allows for direct comparisons within the athlete and reduces the bias that arises from differences in characteristics between participants (James & O'Connor, 2023; Jelen et al., 2024; Reinebo et al., 2023). In the context of this study, each athlete of Pelatda Mataram City was tested on two different forms of pointing techniques to see changes in throwing accuracy at 7 meters.

Substantively, this design still refers to the original purpose of the study, which is to determine the effect of standing pointing and squat pointing exercises on athletes' pointing skills. The selection of repetitive measurement designs is also in line with longitudinal analysis recommendations in sports science that place the subject as a fixed factor of observation, while the exercise technique is treated as a condition that is compared in different measurement times (James & O'Connor, 2023; Jelen et al., 2024; Reinebo et al., 2023). However, because this design does not use randomization of treatment sequences, the potential for order bias, learning effects, and the effect of practice adaptation are still recognized as design limitations. To minimize these influences, the two training programs are arranged with an equivalent load, frequency, duration, and structure, and are carried out under the same field conditions. Thus, this study design allows researchers to evaluate performance changes more sensitively than a separate inter-group design.

Participants and Sampling Technique

The population in this study is all Petanque athletes who are members of the Mataram City Regional Training Center (Pelatda) in 2026 which totals 12 people. Because the population is relatively small, all population members are used as research samples using total sampling or saturated sampling techniques. Thus, the research sample consists of 12 active athletes who are being prepared to participate in the 2026 NTB Provincial Sports Week (PORPROV) XII. The selection of the entire population as a sample provides the advantage of being fully representative of the study target group, as well as in accordance with the within-subject design characteristics, which can still provide robust information despite the limited number of subjects, especially if each subject undergoes repeated measurements under more than one engineering condition (Schöllhorn et al., 2022).

All subjects were treated as active participants in two treatment conditions. In this way, each athlete serves as a control for himself. The approach is relevant to motor skills research because differences in basic ability, playing experience, and physical readiness between athletes can be minimized in the interpretation of results. However, the small sample size causes the generalization of research results to be limited, and the findings are more accurately understood as empirical evidence in the context of athletes of Pelatda Mataram City. Therefore, the characteristics of the sample in this study are considered adequate to answer the purpose of the study, which is to compare the effect of two pointing techniques on the accuracy of throws at a fixed distance.

Instruments and Measurement Procedures

The main instrument used in this study was the Petanque pointing skill test at 7 meters. Measurements were carried out using a set of tools in the form of a Petanque ball (boules), a target ball (cochonnet), a throwing circle, a target circle, a scoring sheet, and stationery. This instrument is used to assess the athlete's ability to place the ball as close to the target as possible through a goal zone-based scoring system. Large circles with a diameter of 100 cm were scored 1, medium circles with a diameter of 50 cm were scored 3, and small circles with a diameter of 30 cm were scored 5. Each athlete makes 6 throws in each technique condition, and the total score is an indicator of pointing skills.

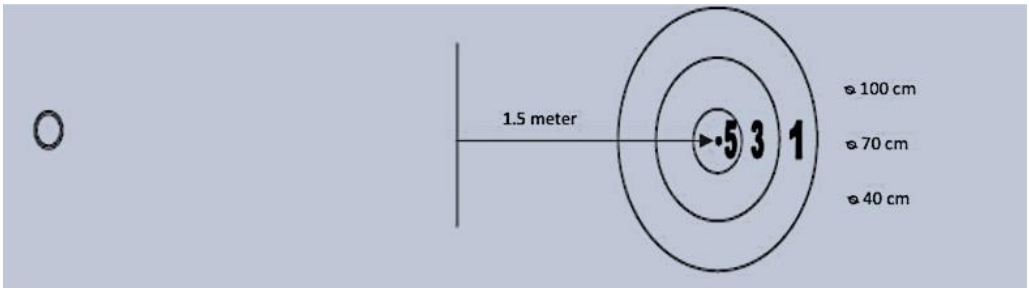

Figure 1. Pointing Instrument Distance 7 Meters

The use of fixed distance-based instruments and score zones is in line with the practice of measuring Petanque skills in various national studies that use a pointing or shooting test at a certain distance with explicit score rules as the basis for comparing pretest and posttest results (Jumadi et al., 2023; Phytanza et al., 2022). The literature also shows that structured and repetitive pointing skills instruments are a practical and repeatable form of assessment to monitor the development of athletes' performance after training interventions. Although modern biomechanics studies also recommend video-based measurements such as Kinovea to objectively obtain ball-to-target distance (Irawan et al., 2022), this study uses score-based field instruments because it is more appropriate for the training context of regional athletes, is easy to apply, and still has practical validity for measuring pointing

accuracy at fixed distances. However, this study did not conduct a statistical test of the validity and reliability of the instrument in the research sample, so the strength of the measurement relied more on the suitability of the instrument with the assessment practices that have been used in previous studies. These limitations need to be observed in interpreting the accuracy of measurement results.

Table 1. Standing pointing training program

Weeks	Focus Training	Frequency	Training Volume	Set	Repetition	Recovery
1	Mastery of basic *standing pointing* techniques includes standing stance, ball holding, arm swing, and ball release to a 7-meter target	3 Times/ Weeks	70%	4	105	2 minutes
2	Improved accuracy and consistency of throw direction on fixed targets and multiple target points	3 Times/ Weeks	70%	5	105	2 minutes
3	Improved throwing precision through score zone drills and jack position variations	2 Times/ Weeks	80%	5	120	3 minutes
4	Reinforcement of technique, release control, and static balance before throws	3 Times/ Weeks	70%	5	105	2 minutes
5	High-intensity training through competitive targets, time pressure simulation, and accuracy evaluation of each set	3 times/ Weeks	85%	5	129	4 minutes
6	Peak performance training with varied targets, final tests, and correction of *standing pointing techniques*	2 times/ weeks	90%	5	135	4 minutes

Tabel 2. Squatting pointing training program

Weeks	Focus Training	Frequency	Training Volume	Set	Repetition	Recovery
1	Mastery of basic *pointing* techniques includes squat posture, ball grip, arm swing, and ball release to a 7-meter target	3 times/ weeks	70%	4	105	2 minutes
2	Improved posture stability, throwing accuracy, and consistency at multiple target points	3 times/ weeks	70%	5	105	2 minutes
3	Improved throwing precision through score zone drills and jack position variations	2 times/ weeks	80%	5	120	3 minutes
4	Technique reinforcement, throw angle control, and squat holding exercises before *release*	3 times/ weeks	70%	5	105	2 minutes
5	High-intensity training through competitive targets, time pressure simulation, and accuracy evaluation of each set	3 times/ weeks	85%	5	129	4 minutes
6	Peak performance exercises with varied targets, final tests, and correction of *pointing techniques*	2 times/ weeks	90%	5	135	4 minutes

The training program is structured over six weeks with the principle of gradual load increase. In the standing pointing technique, the exercise is focused on mastering basic techniques, improving the accuracy and consistency of throws, strengthening release control and static balance, to performance simulation and final tests. In the pointing technique, the training is directed at mastering techniques from the squatting position, improving posture stability, throwing accuracy, throwing angle control, to performance simulation and final evaluation. The frequency of training is carried out 2–3 times per week, with the volume of training increasing from 70% in the initial phase, 80% in the third week, 85% in the fifth week, and reaching 90% in the sixth week. The number of sets, reps, and recoveries are arranged equally in both programs, so the main difference lies in the characteristics of the movement techniques practiced. To maintain equality of treatment, both programs are

implemented with an equivalent duration, frequency, and training load and under the same procedural supervision. However, because the implementation of Squat pointing exercises is carried out at different times or months, the possibility of external conditions such as general training adaptation, fatigue, or changes in the physical readiness of athletes cannot be eliminated. Thus, the difference in results obtained is more reflective of the influence of the type of exercise technique given than the difference in the dosage of exercise.

Data Collection Procedure

Data collection was carried out through the stages of pretest, treatment training, and posttest. In the initial stage, all athletes took a 7-meter distance pointing skill test to obtain basic ability data before treatment. After that, the subjects underwent an exercise program that included two techniques, namely standing pointing and squat pointing. In its implementation, each athlete performs both forms of training according to the program that has been prepared during the research period. After the entire training program is completed, a posttest is carried out with the same measurement procedure as in the initial stage.

In addition to test and measurement techniques, this study also uses structured observation to ensure that each athlete performs the technique according to the procedure, for example, the position of the feet remains in the circle, the posture according to the technical conditions, and the throws are carried out following the same implementation rules. Documentation in the form of administrative records and photographs is used to support the traceability of the research process. The implementation of the data collection procedure under these uniform conditions is important so that the changes in scores that appear truly reflect the effects of the exercise, not the result of differences in measurement situations. In sports performance research, the consistency of procedures like this is an important part of efforts to maintain measurement reliability, although this study does not calculate advanced reliability indices such as ICC, SEM, or MDC as recommended in the cutting-edge methodological literature (Brandl et al., 2023; Makaracı et al., 2023; McCarthy et al., 2023). Thus, the control steps in this study are more procedural than fully experimental. This study seeks to suppress bias through uniformity of tools, distances, test rules, and training programs, but has not been able to fully control all external variables that can affect athletes' performance.

RESULTS

The results of this study are presented to show changes in athletes' pointing skills before and after being given standing pointing and Squat pointing training treatment at 7 meters. In sports skill-based research, the presentation of average values, standard deviations, change scores, and effect measures is very important because it can explain not only the existence or absence of changes, but also the magnitude of the performance improvement that occurs. Therefore, the results of this study are presented through descriptive statistics, normality tests, paired sample t-tests, and comparison of effects sizes between techniques. The basis for presenting these results follows the practice of sports performance improvement reporting which emphasizes pre-post averages, standard deviations, score changes, and effect measures to show the statistical significance as well as the practical meaning of changes in athlete performance.

Table 3. Data of normality test result

	Pre Test		Post Test	
	Pointing	**Standing Pointing**	**Pointing**	**Standing Pointing**
Valid	12	12	12	12
Missing	0	0	0	0
Median	16	16	22	21.5
Mean	15.67	16.5	22.42	21.5
Std. Deviation	2.535	2.78	2.778	2.97
Variance	6.424	7.727	7.72	8.818
Shapiro-Wilk	0.882	0.964	0.924	0.909
P-value of Shapiro-Wilk	0.094	0.841	0.324	0.207
Range	7	10	8	11
Minimum	12	11	18	15
Maximum	19	21	26	26
Sum	188	198	269	258

All research data (see table 3) both in pretest and posttest conditions for pointing and standing pointing techniques, show a normal distribution. This is shown by the Shapiro-Wilk p value in all groups greater than 0.05, namely 0.094 in pretest pointing, 0.841 in pretest standing pointing, 0.324 in posttest pointing, and 0.207 in posttest standing pointing. Thus, the data meets the assumption of normality so that it is worth analyzing using parametric statistical tests. Methodologically, these results support the use of *the paired sample t-test* as a test of changes in *within-subject* design, as recommended in longitudinal studies or repeated measurements of exercise performance (Newans et al., 2022; Owen et al., 2022; Zhang et al., 2024).

Descriptively, there is a tendency to increase the average score from pretest to posttest in both techniques. In the pointing technique, the average value increased from 15.67 to 22.42, while in the standing pointing technique it increased from 16.50 to 21.50. The median value also showed a similar pattern of improvement, from 16 to 22 on pointing and from 16 to 21.5 on standing pointing. The distribution of data across all groups was relatively homogeneous, which was reflected in the standard deviation values that did not differ too much, ranging from 2.535 to 2.970 so that the quality of the data could be assessed well to support further analysis. However, the similarity of these standard deviations does not in itself negate the possibility of variation in responses between individuals, so the interpretation of the results still needs to be read alongside the inferential statistics and effect measures. This pattern is in accordance with the literature recommendation that the interpretation of performance improvement should not only mention differences but also show the magnitude of the change so that the results are more informative and practically relevant (Brandl et al., 2023; Choudhary, 2025; Villarino, 2025).

Effect of Standing Pointing Training

Table 4. Standing Pointing Paired Sample T-Test Result

Pre Test	Post Test	t	df	p	Cohen's d	SE Cohen's d	95% CI for Cohen's d	
							Lower	Upper
Standing Pointing	Standing Pointing	-9.319	11	< .001	-2.690	0.399	-3.922	-1.434

There was a very significant difference between the pretest and posttest scores in the standing pointing technique (see table 4), with a value of t (11) = -9.319 and $p < 0.001$. These results show that standing pointing exercises have a real effect on the improvement of athletes' pointing ability after treatment. The direction of a negative t-value indicates that the posttest score is higher than the pretest score, so it can be interpreted that the athlete's performance has improved after participating

in the training program. In addition, Cohen's value d = -2.690 indicates a very large effect size, which means that the effect of exercise is not only statistically significant, but also practically strong. This is reinforced by the 95% confidence interval for Cohen's d which is in the range of -3.922 to -1.434, which does not cross zero, thus supporting the stability and consistency of the intervention effect. However, the term "highly effective" in this context needs to be understood as limited to the context of the sample and the research design used, rather than as an absolute generalization for all Petanque athletes. Thus, it can be concluded that standing pointing exercises have proven to be very effective in improving the pointing skills of petanque athletes.

Argumentatively, these results are in line with the literature that states that repetitive and task-specific standing throwing exercises improve motor learning, accuracy, and more precise release mechanics transfer (Irawan et al., 2022). Progressive, repetitive exercises allow athletes to acquire more stable movement patterns, consolidate ball release control, and transfer training results to test performance. In the context of standing techniques, an upright body position provides an opportunity to optimize visual alignment, control of the direction of the throw, and coordination of all segments of motion. This argument is also strengthened by the study of biomechanics. The literature suggests that effective standing throw relies on the transfer of kinetic chain energy from the lower limb to the pelvis, torso, and then to the throwing arm, so that the speed and angle of release can be better controlled (Evans & Bini, 2023; García-Carrillo et al., 2025; Kelmendi et al., 2021). In addition, good postural stability and base of support in a standing position help maintain the consistency of the release geometry and reduce the variability of throw results (Evans & Bini, 2023; Zemková & Zapletalová, 2022).

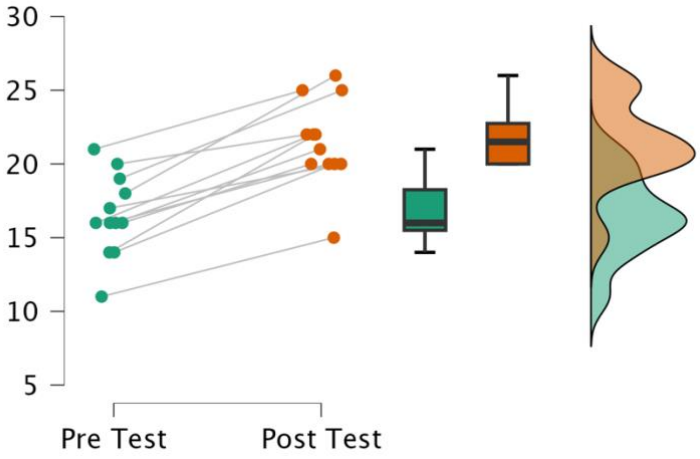

Figure 2. Differences in Pre and Post Test Standing Pointing Results

The results of standing pointing showed a tendency to improve consistent performance from pretest to posttest in most participants. Visually, the pretest score is in the range of 11 to 21, while the posttest score is in the higher range, which is 15 to 26, which indicates a shift in performance towards a better direction after the training treatment. The pattern of individual lines that mostly moved up from pretest to posttest confirms that most athletes experience an increase in score after the intervention. In addition, the boxplot in the posttest showed a higher median than the pretest, indicating an increase in the central tendency of test results. The score distribution in the density plot also shows a more dominant concentration of posttest scores at a high-performance level than a pretest. Although visualization supports improvement, the reading of the graph is still descriptive and needs to be interpreted together with the results of the statistical test so as not to produce conclusions

that are too far. Overall, this visualization pattern supports the statistical results that standing pointing exercises are related to improving the pointing skills of Petanque athletes.

Effect of Squatting Pointing Training

Table 5. Squatting pointing paired sample t-test result

Pre Test	Post Test	t	df	p	Cohen's d	SE Cohen's d	95% CI for Cohen's d	
							Lower	Upper
Pointing	Pointing	-7.745	11	< .001	-2.236	0.612	-3.304	-1.141

There was a very significant difference between the pretest and posttest scores in the squatting pointing technique (see table 5), with the value t (11) = -7.745 and p < 0.001. These results show that squatting pointing exercises have a real effect on the improvement of athletes' pointing ability after treatment. A negative t-value indicates that the posttest score is higher than the pretest score, so it can be concluded that the athlete's performance has improved after participating in the training program. As in the standing technique, the reporting of results by paired tests and effect measures is in line with the standard analysis in sports performance studies based on repeated measurements (Brandl et al., 2023; Freitas et al., 2024). In addition, Cohen's value d = -2.236 indicates a very large effect size, which means that the effect of exercise is not only statistically significant, but also practically strong. This is reinforced by the 95% confidence interval for Cohen's d which is in the range of -3.304 to -1.141, which does not cross zero, thus confirming that the effects of the intervention are consistent and convincing. In the framework of the results argument, it shows that the change in performance after training is large enough to be considered meaningful in the context of athlete coaching. The methodological literature confirms that effect measures like this provide a more solid basis for asserting the effectiveness of interventions than relying solely on p-values (Brandl et al., 2023; Freitas et al., 2024).

Descriptively, pointing even showed a larger average increase than standing pointing, which was 6.75 points compared to 5.00 points. These findings can be explained by referring to the literature on low body positioning in precision tasks. Although direct evidence on the comparison of squatting and standing in Petanque is limited, postural balance studies suggest that squatting or low body positions can reduce postural sway and improve stability in some pointing and throwing tasks, especially when endpoint control is critical (Zemková, 2022; Zemková & Zapletalová, 2022). In the context of this study, the squatting position likely helped the athlete lower the body's center of gravity, increase stability during the release phase, and improve control of the ball's drop point at 7 meters. However, because direct comparative evidence in the Petanque branch is still limited, this explanation should still be read as an interpretation supported by the relevant literature, not as a mechanism that has been directly tested in this study. The available literature still confirms that direct *head-to-head evidence* between squatting and standing positions in Petanque pointing is not widely available, so the interpretation of squatting superiority is more appropriately seen as the empirical findings of this study which are indirectly supported by the general biomechanics literature and postural balance studies (Irawan et al., 2022; Zemková, 2022).

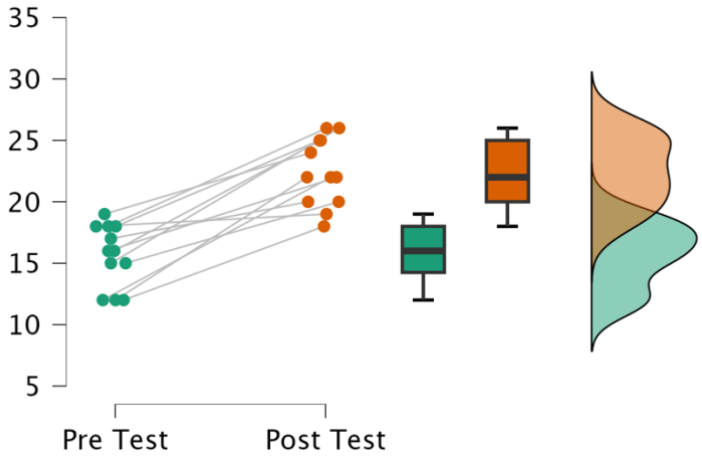

Figure 3. Differential of pre and post test squatting pointing results

The results of squatting pointing showed a tendency to improve consistent performance from pretest to posttest in most participants after being given the exercise treatment. Visually, the pretest score is in the range of 12 to 19, while the posttest score increases to a higher range, which is 18 to 26, so that there is a shift in the distribution of scores towards better performance. The pattern of individual lines that mostly moved up from pretest to posttest showed that almost all athletes experienced an increase in score after the intervention. In addition, the boxplot in the posttest showed a higher median than the pretest, which indicates an increase in the central tendency of test results. The density plots pattern on the right side also shows that the concentration of posttest scores is more at a high value level than pretest scores. As with the standing technique, this visualization reinforces the descriptive reading, but it is not sufficiently used independently to infer the dominance of the technique without the support of inferential analysis. In general, this visualization supports the finding that squatting pointing practice is related to improving the pointing skills of Petanque athletes.

Comparative Analysis Between Techniques

Table 6. Comparation Based Effect Size

Technique	t	Cohen's d
Standing	-9.319	-2.690
	-7.745	-2.236

A comparative analysis between standing and techniques was conducted to determine the training methods that provide greater performance improvements in athletes. The results of the paired samples t-test showed that both techniques significantly improved performance from pretest to posttest, with a p value of < 0.001 in both conditions. However, the difference is seen in the magnitude of the improvement produced by each technique. The standing pointing technique showed a higher t-value (t = -9.319) compared to the technique (t = -7.745), which indicated a stronger change between pretest and posttest scores. In addition, the effect size of the standing technique (Cohen's d = -2,690) was larger than that of the technique (Cohen's d = -2,236), suggesting that the practical impact of the standing exercise was more significant. Based on methodological grounds, such an interpretation is appropriate because the literature suggests comparisons between conditions in *within-subject design* are not only seen from the mean change, but also from the effect measures that illustrate the strength of the intervention's impact relative to data variation (Brandl et al., 2023; Freitas et al., 2024).

These results suggest that although squatting techniques produce greater average increases descriptively, standing techniques show stronger impacts inferentially and practically. Therefore, the

claim that standing techniques are "more dominant" needs to be placed proportionally, i.e. as a tendency of results in the context of the data of this study, not as a universal conclusion. The argument for this result is in line with the literature that states that standing configurations tend to favor accuracy in Petanque, mainly because it provides favorable release geometry, good stability, and more liberal coordination of body segments in medium to long-distance throws (Helmi et al., 2024; Irawan et al., 2022). Previous empirical evidence even suggests that standing pointing at about 9-meters can produce a very precise ball-to-target distance, about 0.14 meters, so that standing positions have a strong biomechanical basis as an accurate technique in Petanque (Irawan et al., 2022).

On the other hand, the literature also mentions that low body positions can help reduce wobble and improve stability on some accuracy tasks, but the findings are contextual and cannot yet be fully generalized to Petanque (Zemková, 2022). Therefore, the results of this study are interesting: pointing provides a larger average increase, but standing pointing still shows a more dominant effect size. This means that in the context of the sample and the conditions of this study, the standing position appears to result in more consistent changes among athletes, although the squatting position remains very effective. Biomechanically, these differences can be explained through the influence of body position on stability, base of support, and kinetic chain coordination. The standing position allows the athlete to optimize the flow of energy from the limbs to the torso and arms, while maintaining the flexibility of adjusting the angle of release. Meanwhile, the squatting position changes the center of mass and the reaction force of the ground, which can be beneficial on certain aspects such as local stability, but the effect can vary depending on the characteristics of the task and the athlete (Torabi et al., 2022; Yüce et al., 2022; Zemková & Zapletalová, 2022). Thus, the comparative results of this study are more appropriately read as differences in the improvement profile between two equally effective techniques, rather than as final evidence of the superiority of one technique over the other.

DISCUSSION

The results of this study show that standing pointing and squatting pointing exercises both provide a significant improvement in 7-meter distance pointing skills in Petanque Pelatda athletes in Mataram City. These findings are essentially consistent with the literature that states that exercise adaptation, both in elite and recreational athletes, involves neuromuscular changes and coordination changes that together support the improvement of more precise, efficient, and reproducible engineering skills, including in throwing motion and accurate target placement (Calabrò et al., 2025; Carretti et al., 2024; Corrado et al., 2023; Diekfuss et al., 2021; Hassar et al., 2025; Kolokythas et al., 2021; Nyland et al., 2023; Patel et al., 2023; Solana–Tramunt & Ródenas, 2025; Yue et al., 2025). In the context of this study, the increase in scores from pretest to posttest on both techniques suggests that the exercises given are likely to support improved motion control, postural stability, and ball release accuracy, even though these mechanisms are not directly measured.

From the point of view of neuromuscular adaptation, the improvement in performance in this study can be explained through improvements in functional strength, force control, and rate of force development that support a more stable and directed release of the ball. The literature explains that increased strength, explosiveness, and neuromuscular control allow athletes to produce faster but still stable release movements, so that targets at certain distances can be achieved with better accuracy, even when athletes are under a state of fatigue or performance stress (Kolokythas et al., 2021; Nyland et al., 2023; Patel et al., 2023; Reuter et al., 2024). However, since this study did not directly measure physiological or neuromuscular variables, this explanation should be understood as an interpretive

framework that reinforces the reading of the results, rather than as an experimentally verified cause-and-effect conclusion.

The findings of this study can also be understood through the contribution of movement coordination and motor control. The literature confirms that proximal-to-distal sequencing as well as the transfer of energy along the kinetic chain from the pelvis and torso to the throwing arm greatly determine the speed of release and the precision of the throwing geometry (Diekfuss et al., 2021; Grooms et al., 2022; Peng et al., 2024). In addition, proximal stability, especially the control of the core and torso, plays an important role in maintaining repetitive discharge patterns and preventing motion compensation that can degrade accuracy (Evans & Bini, 2023; Zemková & Zapletalová, 2022). The results of this study showing improvements in both techniques can be interpreted that the exercises performed have helped athletes align the sequence of motion between joints, improve release time, and streamline the ball's trajectory towards the target This interpretation is relevant to the data obtained, but it remains inferential because this study does not include video analysis, kinematics, or detailed motion measurements that can objectively explain the change in technique. Thus, the increase *in pointing* in this study is safer to understand because of increasingly consistent motor learning after training.

In terms of standing pointing techniques, the results of the study showed a very strong effect statistically and practically. These findings are in line with the literature that specifically and progressively performed standing throwing exercises can improve accuracy through the process of acquisition, consolidation, and transfer of precise release mechanics (Irawan et al., 2022). Biomechanically, standing positions provide advantages in the form of natural base of support stability, greater freedom of movement, and opportunities to optimize energy transfer from the legs, pelvis, torso, shoulders, elbows, to wrists (Evans & Bini, 2023; García-Carrillo et al., 2025; Kelmendi et al., 2021; Torabi et al., 2022). The literature also confirms that the discharge geometry in throwing movements is strongly influenced by the speed of release, the angle of release, and the coordination of body segments, all of which are easier to regulate when the athlete has a stable posture and sufficient movement space in a standing position (Cao et al., 2025; García-Carrillo et al., 2025; Kelmendi et al., 2021). Nonetheless, these findings do not automatically prove that standing technique is always superior in all match situations, as surface conditions, distance, competition pressure, and individual characteristics of athletes were not specifically tested in this study. Therefore, the advantages of standing techniques in this study are more appropriately understood as the tendency of results in the context of the sample and the procedures used.

However, the pointing technique in this study also showed a very significant improvement. This result is interesting because it shows that low body position can also be an effective strategy to improve accuracy at 7 meters. Theoretically, the squatting position lowers the center of gravity, expands functional stability, and potentially reduces postural sway during the aiming and release phases, especially when athletes need finer control at the point of the ball dropping (Zemková, 2022; Zemková & Zapletalová, 2022). The biomechanics literature also suggests that posture changes can alter joint angle configuration, torso orientation, and energy transfer patterns, thus influencing the speed and direction of projectile release (Eltayeb, 2023; Evans & Bini, 2023; Kelmendi et al., 2021; Torabi et al., 2022). In precision tasks, slower, controlled movements in the final phase often improve accuracy because it provides more opportunities for sensorimotor systems to process feedback and fine-tune endpoint control. This may explain why the squatting technique in this study showed a larger average increase in scores descriptively, although the effect size was slightly lower than the

standing technique. Thus, the improvement in the squatting technique can be explained by the possible advantages of stability and smooth motion control made possible by the low posture.

However, comparative results show that while pointing results in a larger increase in average scores, standing pointing has a more dominant effect measure. These findings show that in the context of this study, standing positions provide more consistent changes relative to variation between athletes. The existing literature does tend to favor standing position as a favorable configuration for Petanque's accuracy at medium to long distances. Irawan et al. (2022), for example, reported that standing pointing at about 9-meters can result in an average distance of the ball to the target of about 0.14 m, which indicates high precision in an upright configuration. On the other hand, the literature also emphasizes that direct evidence of head-to-head between squatting and standing positions in Petanque is still limited, so the superiority of either technique cannot be absolutely generalized to all contexts, surfaces, distances, and conditions of athletes (Irawan, Ghassani, et al., 2022; Zemková, 2022). Therefore, the discussion of the results in this study should not be directed to establish the absolute superiority of standing techniques, but rather to show that both techniques are equally effective but provide different improvement profiles. The standing position appears more consistent based on the effect size, while the squatting position shows a larger average increase descriptively.

In addition to biomechanical and neuromuscular aspects, the results of this research can also be read through the perspective of sensorimotor integration. The literature shows that exercises that target sensorimotor integration, proprioception, motor imagery, external focus of attention, and multisensory feedback consistently improve skill execution and its transfer to sports tasks (Carretti et al., 2024; Cederström et al., 2024; Corrado et al., 2023; Diekfuss et al., 2021; Peng et al., 2024; Solana–Tramunt & Ródenas, 2025). In Petanque, the ability to estimate the point of drop of the ball, control the direction of the roll, and adjust the force of the throw relies heavily on the integration between visual perception, body sensation, and precise motor programming. Thus, the improvement in training results in this study likely also suggests that athletes are getting better at linking the target's visual information with motion control when releasing the ball. This means that technique training not only mechanically improves the body but also strengthens the connection between perception and movement.

Practically, the results of this study have direct implications for Petanque coaches. The modern training literature emphasizes that effective engineering programs should incorporate neuromuscular loading, coordinating demands, rich feedback, and task-specific drills to make the motor learning process faster, more durable, and easily transferred to match situations (Corrado et al., 2023; Diekfuss et al., 2021; Kakavas et al., 2025; Kolokythas et al., 2021; Nyland et al., 2023). Based on the results of this study, standing pointing exercises can be prioritized as one of the main techniques to improve consistency and practical effect of performance, while pointing remains relevant as a useful support technique in certain situations, especially when additional stability or ball drop control is more needed. However, these practical recommendations should be applied flexibly and not ignore the individual characteristics of athletes, as this study has not compared training responses based on different levels of experience, technique preferences or physical profiles. Such an integrative approach is more appropriate than relying on just one technique, as the literature also shows that the most powerful generalizations in precision sports are obtained when exercise combines postural stability, biomechanical coordination, sensorimotor learning, and neuromuscular adjustment simultaneously (Corrado et al., 2023; Diekfuss et al., 2021; Hou et al., 2025; Liang, 2025; Solana–Tramunt & Ródenas, 2025).

However, the results of this study need to be read with some limitations. The literature confirms that research on the relationship between neuromuscular adaptation, coordination, and exercise accuracy still requires more robust longitudinal experiments, larger sample sizes, and integration between neurophysiological data and biomechanical outcomes (Calabrò et al., 2025; Grooms et al., 2022; Hou et al., 2025; Kakavas et al., 2025; Peng et al., 2024; Yue et al., 2025). This study has not directly measured biomechanical variables such as release angle, swing time, torso stability, or ball-to-target distance-based video data. In addition, the small sample size, the absence of randomization of treatment sequences, the statistical validity and reliability of the instruments have not been tested, and the possibility of external variables during the implementation of two training programs at different times are also important limitations in the interpretation of the results. These limitations explain why the discussion in this study must remain cautious in interpreting the mechanism and in comparing the dominance between techniques. Therefore, the explanations given in this section are still inferential based on the pattern of results and literature support. Future research should combine accuracy measurements with video analysis, real-time feedback, and test conditions that consider fatigue, surface variation, and distance changes to more comprehensively understand the differences in effectiveness between standing and squatting techniques.

CONCLUCION

This study concludes that standing pointing and Squatting pointing exercises are equally effective in improving 7-meter distance pointing skills in Petanque Pelatda athletes in Mataram City The results of the analysis showed that both techniques provided a significant improvement between the pretest and posttest, making them both feasible to use as part of the Petanque basic technique coaching program. Descriptively, the practice of pointing results in a greater increase in the average score, which suggests that low body position can provide advantages in postural stability and control of the ball's drop point at medium distances. However, inferentially and practically, standing pointing exercises show a larger effect size, so they can be seen as more dominant in producing consistent performance improvements. These findings show that the effectiveness of pointing techniques is not only determined by the final score result, but also by the interaction between body stability, movement coordination, release geometry, and neuromuscular adaptation formed during exercise. The contribution of this research lies in providing empirical evidence regarding the comparison of two pointing techniques in the context of regional athletes, which has been limited to the Petanque literature. Thus, the results of this study can be the basis for trainers to develop a more targeted training program, by prioritizing standing pointing as the main technique and maintaining pointing as a tactical variation. Further research is suggested involving larger samples, longer duration of exercises, and more detailed biomechanical analysis.

RECOMENDATION

Based on the findings and limitations of this research, further recommendations can be directed to two domains, namely research development and practical application in athlete coaching. In the realm of research, subsequent studies need to involve larger sample sizes, stricter designs, and better control of external variables to increase the power of inference. Randomization of treatment sequences, the use of clearer comparison groups, and repeated measurements at more controlled conditions will help minimize sequence bias, learning effects, and the influence of general practice adaptation. In addition, methodological strengthening also needs to be carried out through testing the

validity and reliability of the instrument, so that the changes in scores obtained truly reflect an accurate improvement in pointing skills. In the realm of analysis, further research is recommended not only to rely on throwing scores, but also to include more objective biomechanics and sensorimotor indicators. Video analysis, release angle measurements, postural stability, swing time, and the actual distance of the ball to the target can provide a stronger explanation of the mechanism by which a technique shows more consistent or greater descriptive improvement. The use of real-time feedback, digital device-based observation, or the integration of perceptual evaluations can also enrich understanding of the relationship between body position, motion control, and pointing accuracy. With this approach, subsequent research not only explains whether a technique is effective, but also why and under what conditions it works more optimally. From a practical point of view, Petanque coaches can use the results of this study as a basis for developing more adaptive exercises, rather than to assign one technique as the sole choice. Standing pointing exercises can be placed as one of the main focuses as they show a larger effect size in this study sample, while pointing remains important to be maintained as a variation of the technique as it shows a higher average increase descriptively. Thus, training programs should be designed flexibly according to the characteristics of the athlete, the situational needs, and the technical goals to be achieved. A coaching approach that comparatively combines the two techniques, accompanied by periodic evaluations of accuracy and consistency of performance, will be more relevant than an approach that emphasizes only one technique absolutely.

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