

# The effects of stance width during barbell hip thrust on power and velocity output among adolescent Silat athletes

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## Abstract

**Background and Study Aim** In the physically demanding combat sport of Silat, strength and power dominate. Consequently, applying various stance widths during barbell hip thrusts may tailor athletes' lower-body exercises to individual needs. This has the potential to optimize performance. The aim of this study is to investigate the impact on performance of power, speed, and stance width among Silat combat athletes.

**Material and Methods** Participants performed 10RM tests in three stance widths: wider than shoulder width (WSW), normal shoulder width (NSW), and narrower than shoulder width (NRW). This was done using a 72-hour counterbalance cross-over study design. Power and velocity were measured and analyzed using a mixed ANOVA design.

**Results** The results indicated a significant main effect of stance width on power ( $F(2,56) = 3.086, p < 0.05$ ) and velocity ( $F(2,56) = 3.683, p < 0.03$ ) output. Both males and females demonstrated the highest power in NRW ( $M = 413.26, SD = 131.76$ ;  $M = 239.53, SD = 111.16$ ), followed by WSW and NSW. A strong positive correlation between power and velocity was observed for all stance widths: WSW ( $r(28) = 0.77, p < 0.001$ ), NSW ( $r(28) = 0.79, p < 0.001$ ), and NRW ( $r(28) = 0.89, p < 0.001$ ). NRW was associated with superior power production, while WSW facilitated higher velocity.

**Conclusions** The results of this study demonstrate the importance of considering a variety of stance width techniques during exercise due to their effects on power and velocity during the barbell hip thrust exercise. Coaches can tailor training programs with a velocity-targeted strength and conditioning approach to enhance performance and competitiveness. Further research should investigate different athlete groups and age levels to refine training methodologies.

**Keywords:** stance width, barbell hip thrust, power, velocity, strength training, Silat

## Introduction

Silat, a traditional martial art from Southeast Asia, typically among Malaysians and Indonesians, is renowned for its diverse and intricate movements encompassing striking and grappling techniques [1, 2, 3]. The physical demands of Silat are multifaceted, requiring skill, agility, muscular power, and endurance. This dynamic and physically demanding art form is an excellent venue for investigating various aspects of athletic performance and biomechanics [4, 5]. In a modern competition format, Silat can further break down into two main categories *Silat Olahraga* (fighting-based) and *Silat Seni* (art-based).

In competitive '*Silat Olahraga*,' *pesilat* (a term for the athlete's Silat) spar with each other, and points are scored based on the execution of techniques [6, 7]. The scoring system typically awards points for attacking and defensive moves, including kicks,

punches, sweeps, and throws. It involves three rounds of sparring, which are 2 minutes per round interspersed with 1-minute rest. Meanwhile, unlike *Silat Olahraga*, a competitive sport version of Silat, '*Silat Seni*' emphasizes aesthetic, artistic, and cultural elements. In *Silat Seni*, *pesilat* performs a series of choreographed movements [8]. The performance usually includes various techniques such as strikes, kicks, and defensive moves, but it also displays the grace and fluidity of the art form. It's pretty similar to forms or kata in Japanese martial arts. The round for each performance is typically around 3 minutes without rest.

As important, strength training has been applied in other combat sports (et., judo, karate, taekwondo) that improves punching force and striking movement [9], as well as reduces the chances of injuries [10, 11]. It played the same role same goes with Silat. This is because, to achieve specificity, similarities should exist between the conditioning session and those required in the field during competition. The dynamic nature of Silat underscores the physical

demand it places on practitioners, encompassing a blend of physical components [2, 4]. In this sense, applying strength training significantly improves overall performance, specifically in Silat. Its effectiveness lies in its capacity to increase strength, power, speed, and endurance, which are fundamental elements in the execution of Silat's diverse techniques, from powerful strikes and kicks to elaborate offensive and defensive maneuvers. Different types of training, approach, and strategies have been applied during a strength training session for the physical demand of Silat.

In the lifting technique during exercise, for example, the stance's width may significantly impact the stability and stress on the spine. For instance, in the sports biomechanics literature, it has been noted that high-force deadlift and squat exercises may affect the kinematics of the trunk and lower extremities and the patterns of muscle coactivation [12, 13, 14]. The biomechanical variety of physical activities can alter joint mechanics and accompanying muscular activity, affecting exercise responses [15].

One frequently utilized lower body limb exercise is the barbell hip thrust (BHT). It is one of the basic technique of exercise that focus on one plane of motion that can be used as one of the protected antecedent movements compared to a more multijoint exercise such as back squat and deadlift. This is crucial for inexperienced athletes or practitioners who may lack the skill or be unfamiliar with hip extension and squatting movement. This is because of the relative simplicity of the activity. As a result, it has been used to increase athletes' speed when running and performance in sports because of the forces produced and the horizontal loads experienced throughout the exercise [16, 17, 18]. It is generally acknowledged that the barbell hip thrust exercise is a risk-free way to build strength over the hip extension range of motion. During the entire duration of the movement, there exists muscular tension. Notably, in comparison to alternative workouts aimed at strengthening the hip, this tension reaches its maximum level during the point of lockout. The lockout point characterizes the hip joint as being in a state of utmost neutrality or slight hyperextension [19, 20, 21].

Moreover, BHT also has been studied in force production on sports performance. Muscle activity using Electromyography (EMG) and kinetic were frequently used to measure force production. For example, peak values during kinetic measurement were 24% and 42% more significant in barbell hip thrust and deadlift than in back squats during lumbosacral and hip extension movement on the force platform [22]. This study suggested that barbell hip thrust demonstrated more hip extension and lower back for strength training with a slightly focused knee extension movement. However,

force production also can be explained using other methods, such as surface electromyography (EMG). One study has shown more strength in hip extension during deadlift compared to barbell hip thrust indicating more activating muscle at the biceps femoris [23].

Stance width is also one of the elements that strength coaches frequently change and apply when performing lower-body movements. Changes in stance width and foot placement are thought to cause various activation of relevant muscles [24, 25]. Many of these foot placements have also been discovered in gait analysis and balance exercises, recovery, rehabilitation, and the workplace [25, 26, 27]. Several other studies have explored the contributions of stance leg muscle spindle afference to the planning of mediolateral foot placement for balance control [28, 29, 30].

Researchers have explored the effects of foot placement on gait analysis, rehabilitation programs, biomechanics, and muscle activity during dynamic tasks within a sport setting [31, 32, 33, 34, 35]. Additionally, some studies have assessed the impact of nonleading foot placement on power and velocity [36, 37, 38, 39, 40]. Nevertheless, there is a substantial understudied aspect of the effect of different stance widths on power and velocity to improve sports performance.

In recent times, a growing body of research has examined the variations in stance width and foot position. In a three-repetition maximum back squat, Larsen et al. [12] explored the effects of stance width and barbell placement on the biomechanic aspects and myoelectric activity in the sticking region. The findings indicated that a higher bar placement was significantly correlated with increased activation in the hip region. In contrast, a lower bar placement was shown to be more strongly connected with activation in the knee region. In a related investigation, the researchers employed a motion capture system to assess three-dimensional kinematics, a force platform to measure ground reaction forces (GRF), and musculoskeletal modeling to estimate muscle forces. In the second experiment, it was observed that the peak power exhibited a considerable increase in the narrow condition. Conversely, both trials demonstrated that the medial ground reaction force (GRF) impulse significantly increased the wide stance. The results of experiment two demonstrated a considerable increase in quadriceps forces under the narrow condition. Additionally, both trials revealed a significant enhancement in posterior-chain muscle forces with a wide stance width [41]. With this information, the effect of back squats, other variations, and various feet and bar placement has been intensively investigated on sports performance.

Over the past decade, the barbell hip thrust (BHT) has gained substantial momentum as a widely used

method of resistance training among recreational and professional athletes specializing in strength and power development. Kinetic, kinematic, and surface electromyography were frequently used to measure force production during exercises. A noticeable difference exists between these approaches utilized to analyse power and velocity performance. Nonetheless, there is scarce evidence on how this foot positioning during stance width affects barbell hip thrusts and other lower body exercises in strength and conditioning settings and power and velocity outputs.

Therefore, this study aimed:

- 1) to examine the effects of different stance widths (Wider than shoulder width, *WSW*; Normal shoulder width, *NSW*; and Narrow than shoulder width, *NRW*) on power and velocity;
- 2) to compare male vs. female during power and velocity output;
- 3) to understand the relationship between power and velocity output during BHT performance in adolescent Silat athletes.

It was hypothesized that there would be no significant difference between the three-stance width on power, velocity production, and gender, and there would be no relationship between power and velocity across the different types of stance width.

## Materials and Methods

### Participants

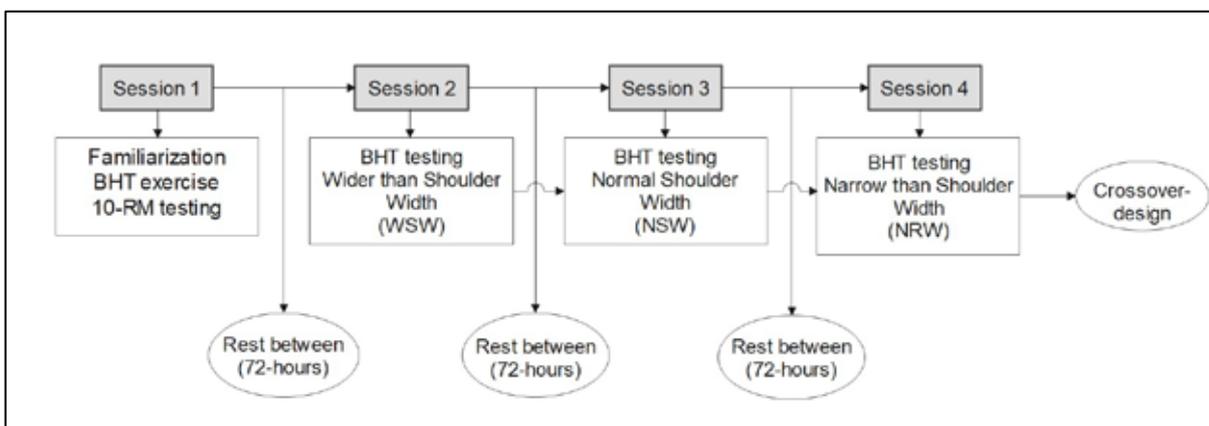
A total of 30 (15 male and 15 female) Silat athletes were involved in this study. The mean age of the Silat athletes was 16 y/s ( $\pm 0.94$ ), weight 36 kg ( $\pm 17.6$ ), and height 147 cm ( $\pm 9.7$ ). The inclusion criterion for the potential participant included (1) at least three years of experience with resistance training; (2) 3 years' of Silat experience; (3) none of the athletes had an injury or illness during the experiment. Written informed consent was obtained from all participants before the commencement of the study, following a detailed explanation of

the experimental protocol, associated risks, and potential benefits of participation.

### Research Design (fig. 1)

The research was conducted throughout four sessions, with a 72-hour gap between each testing day. The participant participated in a familiarization session (Session 1) to familiarize themselves with the experimental protocols. During the same assessment, the researchers evaluated the one repetition maximum (1RM) for the bench press exercise to determine the participants' ten-repetition maximum (10RM) [42]. After the initial session, participants were randomized cross-over for the rest of the testing session (Session 2 – session 4). All testing sessions were conducted in the same indoor facility and adhered to a standardized schedule from 5:00 pm to 8:00 pm. To mitigate the occurrence of excessive fatigue-induced effects, athletes were provided with instructions to abstain from engaging in strenuous training activities within 24 hours preceding each day of testing. Additionally, athletes were strictly prohibited from partaking in the consumption of illegal stimulants within a 24-hour timeframe prior to the commencement of the testing process.

Before the main execution of the testing day, subjects visited the indoor hall to familiarize themselves with barbell hip thrust. Strength training equipment such as barbells and plates has been set up at the indoor arena to suit the 'Silat' competition's feel. Seventy-two hours following a period of familiarization and strength testing, all participants engaged in the main experimental trial. During the main trial session (Session 2 – Session 4), the subject underwent a 10-minute standardized warm-up, emphasizing warming up musculature associated with lower body parts. Subsequently, three warm-up sets were executed, each including incremental increases in the weight of the barbell. Then, each respective subject completed supplementary sub-maximal repetitions, and individual ten-repetition maximums (10RMs) were



**Figure 1.** Research framework.

determined in accordance with the methodology outlined by Baechle and Earle [42].

#### *Testing procedure*

##### *Strength testing (fig. 2)*

A within-subject randomized and counter balanced repeated measure design was used to analyze the 10-RM strength in barbell hip thrust (BHT). In order to ensure that any observable effect during the main trial was solely attributable to the pre-load stimulation (incrementally loaded warm-up), a standardized 5-minute recovery before 10-RM was established. This was to ensure no carryover effect because of the pre-load stimulus. The subject then performed 15- repetitions at approximately 50% of 10RM followed by 12 repetitions at 70% 10RM, and the subject will be asked to lift and stop the loaded that was roughly estimated as their 10RM load based on Baechle and Earle [42] repetition maximum procedures. The logic is that because subjects were young athletes and 10RM strength testing was suitable for their level based on safety purposes.

During the execution of the barbell hip thrust exercise, participants were instructed to consistently elevate the barbell to a predetermined height in each trial. Additionally, they were provided with continuous feedback to ensure no tilting of the barbell at its highest point. The one repetition maximum (1RM) was measured as the maximum amount of weight lifted until the individual could not achieve the barbell's peak height during the concentric phase. Participants were instructed to position their upper back on a bench. The barbell was positioned at the crease of their hips, and a barbell pad was used to minimize any potential discomfort. Participants were provided with instructions to stretch their bodies via the hips, ensuring that their feet remained securely grounded.

##### *Stance width (table 1)*

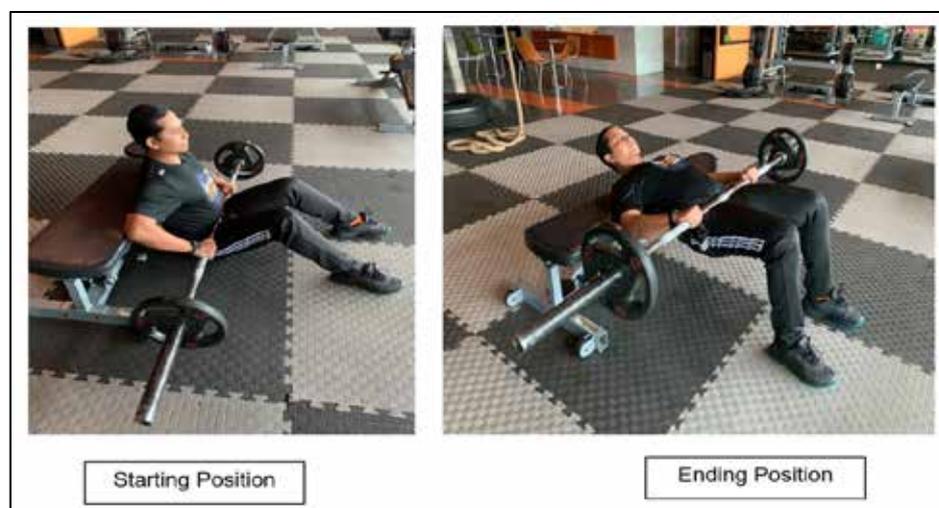
Three different stands were measured in this study (Wider than shoulder width (WSW), Normal shoulder width (NSW), and Narrow than shoulder width (NRW). Subjects were cross-over, randomized, and assigned according to the difference in stance width. For wider than shoulder width, subjects will put their feet approximately 10cm outside from the acromioclavicular joint with the toes pointing forward. Meanwhile, the subject will put their feet approximately 10cm inside the body from the acromioclavicular joint for the narrow stance width. Lastly, with normal shoulder width, the feet will be standing directly the same with the shoulder width in line with the acromioclavicular joint.

##### *Power and Velocity*

In the barbell hip thrust exercise context, the mean concentric bar velocity was measured by utilizing a FLEX device positioned on the right-hand side of an Olympic barbell (Eleiko Performance Weightlifting Bar, Sweden). A reflective marker was affixed to the middle of the device, oriented outwardly. A reflective mat was employed throughout both workout sessions to measure force displacement. This mat was positioned precisely beneath the barbell, ensuring all repetitions were closely observed and recorded. Subsequently, the device was linked via Bluetooth to an iPad (iPad Pro; Apple, Inc., Cupertino, CA) that operated the FLEX Stronger app (Kinetic, Canberra, Australia; firmware version: A714). This app exhibited all the recorded data. The performance measures of the FLEX will utilize power and velocity output [43, 44].

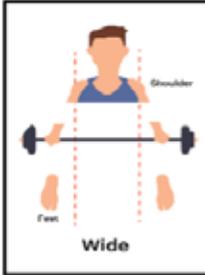
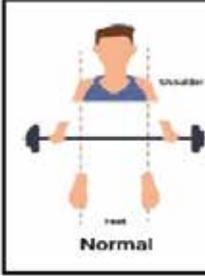
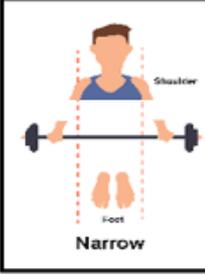
##### *Statistical Analysis*

Statistical analysis used Statistical Packaging for Social Sciences (SPSS) Statistics version 25. Mixed design ANOVA was used to assess the differences in stance width between Wider than shoulder width



**Figure 2.** Barbell hip thrust technique.

**Table 1.** Type of stance width

Position	Stance Width	Feet placement
Wider than shoulder width (WSW)	Approximately 10cm outside the acromioclavicular joint	
Normal shoulder width (NSW)	Directly in line with the acromioclavicular joint	
Narrow than shoulder width (NRW)	Approximately 10cm inside towards the body from the acromioclavicular joint	

(*WSW*), Normal shoulder width (*NSW*), and Narrow than shoulder width (*NRW*). Descriptive statistics (mean ± SD) were used to report the demographic data of the study. The statistical significance level was accepted at  $p < 0.05$ . Mauchly's test was used to assess sphericity, and if not violated, Sphericity-assumed was applied to the result ANOVA. Pearson correlation analyses were also run at each stance width for power and velocity output during the BHT execution.

**Results**

Detailed characteristics of the examined groups can be found in Table 2.

**Table 2.** Physical characteristic and training experiences.

Demographics and Anthropometric	M	SD
Age (years)	16	2.2
Weight (kg)	36	17.6
Height (cm)	147	9.7
Silat (years)	2	2.4
Strength Training (years)	2	1.9

Values are expressed as means ± standard deviations.

*Power output*

From Table 3, this study showed there was a

significant main effect on the type of stance width on power,  $F(2,56) = 3.086, p < .05$  and velocity,  $F(2,56) = 3.683, p < .03$ . For power production, males showed the highest power with *NRW* ( $M = 413.26, SD = 131.76$ ), followed by *WSW* with ( $M = 374.33, SD = 131.96$ ) and *NSW* with ( $M = 363.06, SD = 161.86$ ) in that particular order. For females, the *NRW* also produced the highest power ( $M = 239.53, SD = 111.16$ ), followed by the *WSW* ( $M = 213.00, SD = 112.61$ ) and the *NSW* ( $M = 189.40, SD = 98.58$ ). Bonferroni adjustment has been used to investigate the differences between stance width further. The result showed a significant main effect that reflects a significant difference ( $p < .04$ ) between *NRW* and *NSW*. However, there is no significant difference between *NRW* and *WSW* and *WSW* and *NSW* ( $p > .51$ ). This suggests that the narrow stance may be more effective for power production during barbell hip thrusts for male and female Silat athletes.

*Velocity output*

The mean velocity production was also calculated, and there were significant differences in the three stance widths. For males, the *NSW* produced the fastest velocity ( $M = .42, SD = .13$ ), followed by *WSW* ( $M = .43, SD = .10$ ) and the *NRW* ( $M = .45, SD = .12$ ). Meanwhile, for females, *NSW* also showed the fastest velocity production during BHT ( $M = .27, SD = .04$ ), followed by *WSW* ( $M = .28, SD = .05$ )

and lastly, NRW with ( $M = .32$ ,  $SD = .11$ ). Velocity's mean data was inversed from the power produced for both genders. The pairwise comparison shows no statistical difference across three types of stance width, with NRW showing a minor level ( $p = .08$ ) towards NSW compared between WSW and NSW ( $p = .09$ ). The test of between-subjects effects shows that there are significant differences in power,  $F(1,28) = 18.35$ ,  $p < .01$  and velocity production,  $F(1,28) = 19.20$ ,  $p < .01$  between males and females. Males generally produced more power and velocity than females across all stance widths, as shown in Table 4.

*Relationship between Power and Velocity*

To evaluate the magnitude and direction of the linear association between power and velocity across various stance widths, a bivariate Pearson's product-moment correlation coefficient ( $r$ ) was computed. Both variables showed a normal distribution, as determined by the Shapiro-Wilk test ( $p > .05$ ). As per Table 5, this study revealed significant positive correlations between power and velocity during barbell hip thrusts in adolescent

Silat athletes across wide, normal, and narrow stances. Specifically, for the wide stance width (WSW),  $r(28) = .77$ ,  $p < .001$ , indicating a significant association between the two variables. This pattern was also observed in the normal stance width (NSW),  $r(28) = .79$ ,  $p < .001$ , and in the narrow stance width (NRW),  $r(28) = .89$ ,  $p < .001$ . The percentage of variance in power explained by velocity ( $r^2$ ) was approximately 59% for the wide stance, 63% for the normal stance, and 69% for the narrow stance. These findings highlight the strong statistical relationship between power and velocity in all tested stances and suggest the potential for velocity-targeted strength and conditioning programs in Silat training. The analysis demonstrated a statistically significant positive correlation between power output and velocity output during barbell hip thrusts in male and female Silat athletes. These findings underscore the strong relationship between power and velocity in various stances during barbell hip thrust exercises in Silat athletes. Therefore, we can reject the null hypothesis and accept the alternative hypothesis.

**Table 3.** Comparison of power output between Males vs Females.

Power output						
Stance	Male		Female		Sig	$\eta_p^2$
	M	SD	M	SD		
WSW	374.33	131.965	213.00	112.618		
NSW	363.07	161.886	189.40	98.580	.05	.09
NRW	413.27	131.765	239.53	111.166		

Values are expressed as means  $\pm$  standard deviations. WSW = wider than shoulder width, NSW = normal shoulder width, NRW = narrow than shoulder width.

**Table 4.** Comparison of velocity output between Males vs Females.

Velocity output						
Stance	Male		Female		Sig	$\eta_p^2$
	M	SD	M	SD		
WSW	0.43	0.10	0.28	0.06		
NSW	0.42	0.14	0.27	0.05	.03	.12
NRW	0.45	0.12	0.32	0.11		

Values are expressed as means  $\pm$  standard deviations. WSW = wider than shoulder width, NSW = normal shoulder width, NRW = narrow than shoulder width.

**Table 5.** Correlation between power and velocity across all stances.

Stance Width	M	SD	1	2	3	4	5
1. WSW Power	293.67	145.81					
2. NSW Power	276.23	158.57	.790**				
3. NRW Power	326.40	148.84	.639**	.767**			
4. WSW Velocity	0.36	0.12	.766**	.822**	.781**		
5. NSW Velocity	0.35	0.13	.630**	.793**	.748**	.832**	
6. NRW Velocity	0.39	0.13	.565**	.709**	.893**	.758**	.692**

\*\*  $p < 0.01$  level (2-tailed);  $N=30$

## Discussion

The barbell hip thrust enhances lower body strength and power, frequently incorporated into strength conditioning, athletic training, and rehabilitation programs [45, 46, 47]. Like the squat, the barbell hip thrust can stimulate diverse muscle groups by modifying the exercise form and precise stance width [17, 47, 48, 49]. Additionally, studies have conducted a comprehensive biomechanical analysis of the barbell hip thrust [48] and examined differences in the electromyographic activity of lower-body muscles in hip thrust variations [49]. Other research has explored the relationships between vertically and horizontally directed muscle power exercises and top-level sprint performance [51, 52]. Stance width is an important consideration when performing strength training exercises as it can significantly influence the muscle groups worked, the intensity of the exercise, your balance, and overall performance. It has been increasingly acknowledged for its role in modifying the mechanical demands of strength exercises and influencing the distribution of muscular engagement, particularly during lower-body workouts. However, very little information regarding applying a variety of stance widths, specifically during barbell hip thrust and combat sports settings. Hence, the researchers examined the effect of different stance widths on power and velocity output. The findings from this investigation offer valuable insights that could significantly impact the optimization of training protocols in Silat. This martial art requires a delicate balance of power, speed, and agility.

Related to different types of stance width studies, the current study revealed that the NRW was associated with the highest power production in male and female athletes. Even though the main effect for both variables (power and velocity) showed a significant difference, the pairwise comparison statistically showed no differences. Associated with a different type of lower body exercise, this finding aligns with previous research based on Sinclair et al. [53], which found peak power improvement in narrow stance width conditions during 70% of 1RM squats. Twenty males took two distinguished experiments (kinematic and kinetic during a squat) where different stance widths, narrow, mid, and wide, were utilized. The study suggested that performing squats with a narrow stance can enhance the stimulus that is required to facilitate enhancements in sports actions that need high levels of mechanical power generation.

The present study further supports the findings of Larsen et al. [12], which found participants lifting >3 kg greater load during low bar narrow stance compared with other squat movement. The study involved (n=18) men and women who performed squats in two distinguished stance positions, high-

bar narrow stance (HBNS) and low-bar narrow stance (LBNS). They proposed the result greater in HBNS because deeper knee flexion angles provide greater squat depth. In relation to muscular activity, it was shown that the vastus lateralis and gastrocnemius muscles had higher activation levels during the narrow stance than the wide stance.

However, in other types of study, for example, foot placement and angles, Escamilla et al. [54] have indicated that there is no statistically significant difference observed among narrow stance squats (NS), medium stance squats (MS), and wide stance squats (WS). There was 15-16% higher muscle activation on hamstring activity in wide high foot placement (WS-LPH) during squat exercise and more on gastrocnemius in narrow stance in the same exercise. Few studies in barbell hip thrust exercise concur with the result showing that a wide stance much better improves compared to a narrow stance [17, 50, 55]. One thing that needs to be seen here is that most studies involving the barbell hip thrust exercise use a wide stance without considering the difference when performing the exercise. Thus, the current research provides knowledge regarding different stances related to barbell hip thrust exercises.

Our study challenges these notions by proposing that the narrow stance may facilitate greater activation of the quadriceps and hamstring muscles, which are crucial for power generation during the barbell hip thrust. Additionally, a narrower stance may emphasize the adductor muscles of the quadriceps as they stabilize the legs during the movement. This increased activation of multiple muscle groups can contribute to overall strength gains and improved performance in the exercise [12, 56]. This observation has profound implications for strength and conditioning practices in a combat sport setting, specifically in Silat, suggesting that a narrow stance during the barbell hip thrust could potentially enhance power-related performance aspects such as striking force during kicking and takedown strength.

In addition to power production, our study also examined the effect of stance width on velocity production. While the differences in velocity production between the stances did not reach statistical significance, the observed trend suggests that a narrow stance may also be advantageous for maximizing velocity production. This could enhance the speed and agility in Silat's performance, which is crucial for executing rapid strikes and evading opponents' attacks. Future research should investigate this trend and its potential implications for Silat's performance.

Interestingly, our analysis revealed significant gender differences in power and velocity production. Across all stance widths, male athletes generally produced more power and velocity

than female athletes. This could be attributed to physiological differences between the genders, such as muscle mass and strength [57, 58]. However, despite these differences, the narrow stance was the most effective for both genders, indicating its universal applicability. This finding underscores the importance of individualized training protocols considering each athlete's unique physiological characteristics while recognizing the effectiveness of specific universal strategies, such as adopting a narrow stance during the barbell hip thrust [46, 59, 60]. Our study also uncovered an interaction effect between stance width and gender on power and velocity production. This suggests that the influence of stance width on these performance metrics may not be uniform across genders. The specific nature of this interaction effect requires further exploration to understand its implications for training and performance in Silat settings.

The limitation of this study pertains to its narrow focus on evaluating the efficiency of three distinct foot positions without delving into more comprehensive aspects, such as muscular activity. In terms of athletes' involvement in this study, the researcher studied the population of young Silat athletes, and it may have different effects if studied at various other age levels. This study also focused only on Silat athletes. Future research in Silat activities should delve deeper into the disparities in foot position across various age groups and athletic proficiency levels. It is also essential to broaden the scope by examining foot positions in activities targeting different fitness components. The effectiveness of these foot positions during offensive maneuvers in Silat remains a crucial area for exploration. To fully understand the implications, subsequent studies must replicate these findings in broader and more diverse samples of Silat athletes while also investigating the underlying biomechanical mechanisms contributing to the observed effects.

## Conclusions

The results of this study suggest significant contributions in enhancing the efficacy of the barbell hip thrust exercise within the context of Silat athletes. The results suggest that a narrow stance during the barbell hip thrust may be the most effective for maximizing power and potentially velocity production among Silat athletes, regardless of gender. Male athletes generally produced more power and velocity than female athletes across all stance widths, which could be attributed to physiological differences between the genders. However, the narrow stance was the most effective for both genders, indicating its universal applicability. An interaction effect between stance width and gender was also detected, suggesting that the influence of stance width on power and velocity production may not be uniform across genders. These findings have significant implications for designing training programs to enhance performance in Silat, potentially contributing to improved competitive outcomes. Future research should aim to replicate and extend these findings in more extensive and diverse samples of Silat athletes across different groups of ages, levels of athletes, and other types of sports and explore the underlying biomechanical mechanisms and physical performance contributing to the observed effects.

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## Conflict of interest

The authors declare no conflict of interest.

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