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The Impact of Force Production on Initial Acceleration Interacting with Block Start Obliquities

J. A. L. N. Jayathunga^{1*}, A. W. S. Chandana¹

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ABSTRACT

This study aimed to improve the block starts initial acceleration performance for 100m athletes. In this research, to have faster block starts, athletes will need to work on starting block position and improve acceleration out of the blocks by using the most suitable block Pendle obliquities. Aim to investigate the during athlete block clearance force production effect on different obliquities in 100m performance in sprinters Initial Acceleration (IA) (0-10 m) Phase. Identify the most accurate block Pendle notches for block clearance performance for using force plate on foot paddles. According to the sample sprinter (n=8) collected data from using Qualisys 3D Motion Capture Analysis Software and Data Analysis through SPSS Statistics (version 27.0). This research employed one group post-test only design to improve acceleration through block start clearance performance force production of 100m sprinters. As supposed, accurate block start obliquities influence the Minimize time in the block clearance performance. Further, Athlete acceleration time also has decreased. That acceleration phase time increment supports the achievement of their personal best timing in 100m events.

INTRODUCTION

The athlete's reaction to the gun and initial application of force against the starting blocks majorly impacts overall sprinting performance, particularly in races of 100m or less (Nagahara, 2020). In the focus is on creating horizontal velocity and putting the athlete's body in position for drive phase. At the set command the athlete raises hips and leans as far forward without moving. With the sound of the gum trunk straightens and lifts as both feet press against the blocks. (Figueiredo, 2021) The hands lift from the ground together then swing alternately. The push of the rear leg should be hard and short, so the leg moves forward rapidly, while the push of the front leg is little less hard but longer (Harland MJ, Steele JR, 1997).

LITERATURE REVIEW

This study aimed to evaluate the initial loading position in a foot block paddle with various notches for block clearance and the accuracy of reaction time friction force in order to calculate the kinetic functions that occur when the centre of mass moves. The block start involves several different considerations. Coaches who are experts assert that the instruction "on your marks" signals the start of the real block start (Jones R, 2009). Numerous researchers in the scientific community have been looking into the question of which of the process's many elements are most important for a certain stage of the race. Some of them have concentrated their efforts on doing research on the lower extremities, specifically in terms of acceleration, feet-to-block lengths, response times, and full-speed 20-meter sprints (Haugen T. A., 2019). In order to achieve a combination of high force power and high maximum force, Harland and Steele established that the sprinter should position his or her

back knee in the "set" position between 90 and 130 °of flexion. Additionally, the sprinter should keep their hips reasonably high. Because of this setting, it is possible to start at a low angle (between 40° and 45 °), which helps to reduce the likelihood of horizontal braking forces (Schrödter, 2016).

The use of starting blocks in sprint competitions helps to decrease the impact of the athlete's feet hitting the ground. This research will be carried out with the goal of determining how a sprinter should best set up each block to provide the greatest possible performance throughout the race. Studies have been conducted to investigate the starting block placements and angles in an effort to improve the starts of sprint races as well as the overall results (Haugen T. A., 2020).

MATERIALS AND METHODS

The Research Design of this study is experimental research to improve sprint block clearance performance (100m) using block Clarence friction force production. The aim of to find out the relationship between force production and fluctuations in block pedal angles to Block Start Performance of the Sri Lankan Athletes.

Research Design

This research that employed One-Group Post-test Only Design to identify The Effect of Friction Force and Initial Acceleration in Block Start Performance.

Testing Procedure

The study area is the Biomechanical Analysis of National Level 100m Sprinters Block Start Performance in Sri Lanka. Using Purposive sampling method select population as, National Athletic 100m sprinters in

¹ Department of Sports Sciences and Physical Education, Faculty of Applied Sciences, Sabaragamuwa University, Sri Lanka

* Corresponding author's e-mail: lahirunijayathunga5566@gmail.com

National Athletic Pool of Sri Lanka and study sample were top 8 Ranked 100m National Sprinters in Sri Lanka National Athletic Pool (Male: n = 4, Female: n = 4) (The Elongated Starting Position).

With ethics approval of the department of sports science and physical education at Sri Lanka Sabaragamuwa university. Provide Information sheet and guideline about the testing protocol. Each Athletes get data from all 16 types various foot angles using force plate which is connected to the foot pedal and 3D laboratory process.

All the Athletes are tests twice and Average Data values, graphs were considering as a result.

Quantitative data statistical analyses will be performed using the Statistical. The entire data will be collected by 100m sprinter on time graphs analysis were provided by the researcher. Excel (Data Streamer Software) and SPSS software (version 27.0) are going to be used in analysing the validated data. The recorded data from the 3D motion capturing video will be analysed by descriptive data analysing (Qualisys 3D Motion Capture Analyse software).

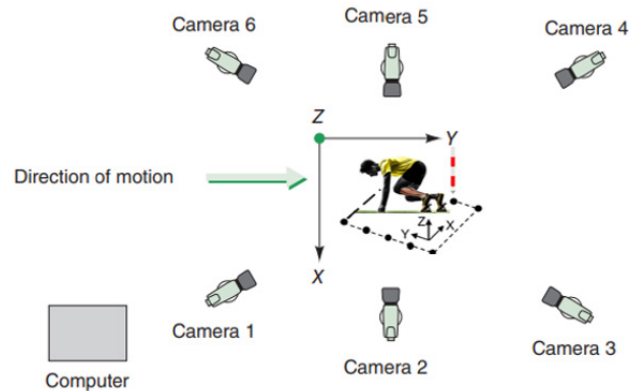


Figure 1: The Experimental Setting for Starting Position of an Athlete

RESULTS AND DISCUSSION

To improve block clearance performance, athletes must focus on strength and power training to enhance force production, which has a direct correlation with acceleration. Kinematic variables such as take-off velocity, take-off angle, joint angles, joint moments, ground reaction forces, flight time, and body position also influence block clearance performance. These variables interact with technique, strength, and fatigue, highlighting the need for further research to identify optimal movement patterns and the relative importance of each kinematic variable. Foot orientation, as determined by oblique lines, can also affect block clearance performance by altering force vectors and kinematic variables. Athletes should consider foot orientation when placing their

feet during take-off. As a summary, the block clearance performance is a complex phenomenon influenced by multiple factors. Further research is needed to fully understand the interactions between force production, kinematic variables, and foot orientation, and to develop evidence-based training interventions to improve block clearance performance.

Statistical Data Analysis

All variables that were assessed underwent descriptive statistics. to evaluate the consistency between the two test sessions for tests 1 and test 2. For testing and follow-up tests on both extremities, the mean, range, and standard deviation for the angle of foot pendle positioning force production were recorded. (Table 1).

Table 1: Correlation summary, Male and Female Athletes foot pendle angle positioning force production. (All (n = 8) the average values are included)

		Front Leg Force	Rear Leg Force	C.G(Block Clearance) X	C.G(Block Clearance) Y
Front Leg Force	r	.138*	.152*	.250*	0.225*
	p	0.037	0.044	0.046	0.025
Rear Leg Force	r	.252*	.157*	0.113*	0.138*
	p	0.046	0.025	0.035	0.026
C.G(Block Clearance) X	r	.138*	.152*	.250*	0.225*
	p	0.036	0.038	0.025	0.035
C.G(Block Clearance) Y	r	.143*	.132*	.254*	0.215*
	p	0.025	0.046	0.044	0.032

*. Correlation is significant at the 0.05 level (2-tailed).

In conclusion, there is a significant positive correlation between Front Leg Force, COG (Block Clearance) X and COG(Block Clearance) Y, and a weaker but significant positive correlation between Rear Leg Force and COG(Block Clearance) Y.

Sprint Acceleration Performance Analysis

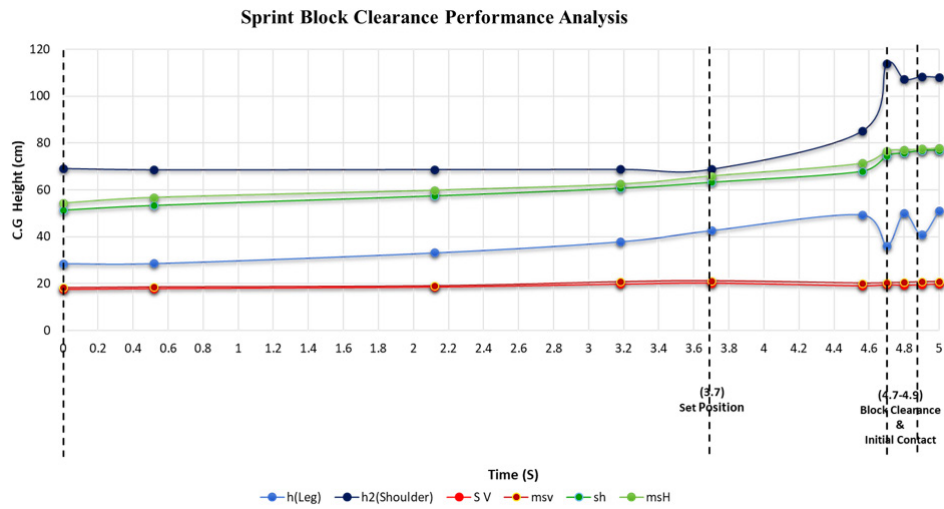


Figure 2: The overall performance of Acceleration

Recommendation for Athletes

Table 2: Final Recommendation for Athletes

Athlete	General Notch		I.A. Performance 10m-(s)	Recommend Notch		I.A. Performance 10m-(s)
	F	R		F	R	
A	3	2	1.84	4	2	1.81
B	1	2	1.93	3	3	1.89
C	3	2	2.102	2	4	2.10
D	3	3	2.16	4	2	2.12

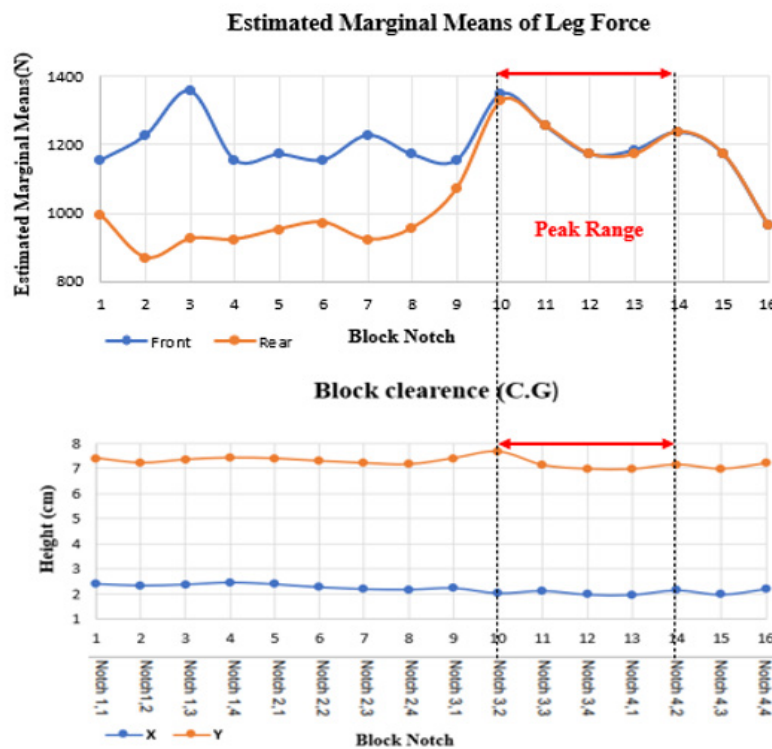


Figure 3 : The Position of COG and Leg Force of Block Clearance of the Athlete

CONCLUSION

The findings suggest that for optimal performance, the foot pedal angle for an athlete's Centre of Gravity positioning parabolic path should be determined based on the block clearance force production for the notch range of 3,2 (50°, 60°) to 4,2 (40°, 60°). This approach can help achieve the most accurate performance. It's important to note that the best starting block notch range may vary from athlete to athlete and it depends on the individual biomechanical and anthropometric characteristics of the athletes. Furthermore, proper training and technique in the starting block position and push-off phase can also improve force production.

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