The Impact of Friction Force and Parabolic Arc Patterns on the Initial Acceleration Interacting with Block Start Obliquities: 100m Sprint

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The importance of this study was to understand the aspects of the sprint start technique of the sprinters and their maximum level of performance differs due to the starting point of the starting blocks. The objective is to design a biomechanical model that identifies the effect of starting block Foot Pendle Obliquities (FPO) on athletes' performance. Further, we determined the relationship between the Centre of Gravity Positioning (COGp) and block clearance force production (BCfp) accuracy of each athlete, that interacts with the obliquities change. Considering the athlete's BCfp at the peak performance for each obliquity, a block start force plate was designed using Load cell Type- SQB/SQB-A/-SS/-ASS, Graphical Programming Language (Python and C++), Visualize Data from Sensors Using Arduino Mega 2560 Microcontroller Board, and an HX711 Amplifier Module + Cool term Programming. The COGp of Sri Lankan national level athletes' (n=4) based on the Body Height and Segment Angles was defined. The athletes were fitted with Qualisys 3D Motion Capture Analysis Software and a High-speed video camera (240 Hz) was set up to observe the performance of initial acceleration. The data were collected and analyzed to determine the impact of friction force, and parabolic arc patterns of the athletes' initial acceleration. The relationship between BCfp and parabolic path performance showed a significant positive person correlation ($p<0.05$). At the optimum performance of initial acceleration, the corresponding range of force production was 1450N - 1600N and the effective notch foot pedal angle was 3, 2 (50^0, 60^0) to 4, 2 (40^0, 60^0). The accurate parabolic arc path of COGp is also observed. Therefore, the biomechanical model may be applied to predict the performance of each short sprinter. Athletes' technical modifications for FPO, body segment positioning, and COGp's parabolic arc will also be helpful to observe during the early acceleration phase.

Keywords: Biomechanical Model, Block Clearance, Force Production, 3D Movement Analysis