STATEMENT OF THE PROBLEM

The statement of the problem was stated as “Kinematical Analysis of Sprinting Performance at Varied Angles of Block in Athletics”.

Objectives of the study

1. To kinematically analyze sprinting performance at varied angles of block in Athletics.
2. To compare the set position at varied angles of block in Athletics.
3. To find out the relationship between dependent variable (sprinting performance) and independent variables (selected linear, angular kinematical & anthropometrical variables) at varied angles of block in Athletics.
4. To determine the key components of set position at varied angles of block in athletics.

Delimitations

1. The study was delimited to the eight male (National / Inter University level) sprinters of Sub Centre Sports Authority of India, Lucknow and Banaras Hindu University Varanasi whose age ranged between 17 to 30 years.
2. The study was delimited on the set position at varied angles of block in athletics.
3. The study was further delimited to the selected anthropometrical, linear Kinematical and angular kinematical variables.
4. The study was conducted in controlled condition but not in natural competitive situation.

Limitations

1. Advance equipment like three-dimension motion analysis software was not used.
2. Other limitations are:-
   a. Weather condition.
   b. Diet of subject.
   c. Height of subject.
   d. Previous training of subjects, the time of testing.

Hypotheses

It was hypothesized that there may not be significance difference between varied angles of block with 30 m sprinting performance.

It was hypothesized that there may not be significance relationship between varied angles of block with 30 m sprinting performance.
Significance of the study

1. The study will examine the different mechanical factors which actually contribute to the sprinting performance.
2. The present study will explore and examine the factors and establish their optimum magnitude in relation to a good performance.
3. The results of the study will throw light on the important kinematical components/variables in crouch start.
4. The coaches and physical educationist may use this reference while imparting coaching to athletes. It will add quantum of knowledge in area of bio-mechanics.
5. The findings of the study would provide a guide-line to the future research investigators in sports Biomechanics and Athletics.
6. The finding will add a new knowledge in the field of Research in physical education and Athletics.

Selection of subjects

Eight male (National / Inter University level) sprinters were selected from Sub Centre Sports Authority of India, Lucknow and Banaras Hindu University Varanasi whose age ranged between 17 to 30 years.

Selection of Variables

The following Anthropometrical and kinematic (Linear and Angular) variables were selected for the purpose of this study:-

**Anthropometrical Variables**

1. Age
2. Weight
3. Fore arm length
4. Lower leg length
5. Foot length
6. Height
7. Hand length
8. Upper arm length
9. Upper leg length

**Linear Kinematical Variables**

1. Height of center of gravity of the body at set position.
2. First step length.
3. First stride length.
4. Speed of the subject.

**Angular Kinematical Variables**

Angular Kinematical Variables on set position (touching the ground by both hand, and both foot) at varied angles of block in athletics.

1. Angle of left ankle joint and Angle of right ankle joint
2. Angle of left knee joint and Angle of right knee joint
3. Angle of left hip joint and Angle of right hip joint
4. Angle of left shoulder joint and Angle of right shoulder joint
5. Angle of left elbow joint and Angle of right elbow joint
6. Angle of left wrist joint. Angle of right wrist joint
7. Angle of trunk inclination
8. Angle of Head Inclination
Criterion Measures

The following criterion measures were adopted for the present study:

Table-1: criterion measures

<table>
<thead>
<tr>
<th>Variables</th>
<th>Tests</th>
<th>Units of Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age of subject</td>
<td>Chronological Age</td>
<td>Year</td>
</tr>
<tr>
<td>Height of the subject</td>
<td>Anthropometric Rod</td>
<td>Meter</td>
</tr>
<tr>
<td>Weight of the subject</td>
<td>Weighing Machine</td>
<td>Kilogram</td>
</tr>
<tr>
<td>Height of centre of gravity on set position at varied angle of block in athletics</td>
<td>Kinovea-forums experimental version-0.8.25</td>
<td>Centimeter</td>
</tr>
<tr>
<td>Speed of subject during 30 meter performance at varied angles of Block in athletics</td>
<td>Manually</td>
<td>meter/second</td>
</tr>
<tr>
<td>Angle of angular kinematical variables at varied angles of Block in athletics</td>
<td>Silicon Coach Pro-7 Motion Analysis Software</td>
<td>Degree</td>
</tr>
<tr>
<td>First step length and first stride length</td>
<td>Silicon Coach Pro-7 Motion Analysis Software</td>
<td>Meter</td>
</tr>
</tbody>
</table>

Collection of Data

The performance of the subject’s, filming protocol and analysis of data is described below:-

Filming Protocol

The video graphic technique was used for collecting raw data. The video graphs were taken by a professional photographer under the supervision of an expert. According to availability of two Casio EX-F1 high speed camera was used, which have frequency from 60 to 300 frames per second (f/s). The data were recorded from sagittal plane and frontal plane. Camera-1 was placed perpendicular from the subject at a distance of eight meters and one meter height above from ground. Camera-2 placed perpendicular to camera-1 and in front of subject performing at varied angles of block in athletics at the distance of ten meters and one meter above from ground. For the purpose of the analysis of this study set position were selected at varied angles of block in athletics. The subject’s had performed 30 meter sprint four times at varied angles of block in athletics.
Statistical Technique

1. To kinematically analyses set position at varied angles of block in athletics, descriptive statistic was used.
2. To compare the different set position at varied angles of block in athletics, analysis of variance (ANOVA) was used.
3. To find out correlation between dependent variable (30 M performance) and independent variables (selected linear & angular kinematical variables) at varied angles of block in athletics, Pearson correlation was used.
4. To find out regression equation between Dependent variable (30 Meter performance) and independent variables (selected linear & angular kinematical variables) at varied angles of block in athletics, Step Wise Method was used.
5. The level of significance was set at 0.05.
6. The data was analyzed by applying SPSS20-Version.

CONCLUSIONS

Based on the finding and within the limitations of the study the following conclusions were drawn.

- The result of the study shows that out of the four combination of Block Angle i.e. 45/45, 45/60, 60/75, 75/90, the better performance in 30m sprinting was found in 45/45 & 45/60 and out of these two preceded combination 45/45 combination yielded better result.
- The reasons of 45/45 being the best combination may be attributed to the facts that lower block angles stretch the calf muscle prior to the explosive contraction during the sprint start. Pre-stretching a muscle in this way has been found to increase the subsequent force production so long as the pre-stretch is of a short duration. Consider the difference between a counter movement jump and a squat jump. A counter movement jump, where the subject squats and then immediately jumps generate more force (and distance or height in the jump) compared to a squat jump, where the subject starts from a squat position. Pre-stretching increases muscle activation and uses the elastic recoil of the muscle to increase force production.
- Block angles influence the initial acceleration of the sprinters.
- Best combination of Block Angle is very important to yield maximum acceleration of athletes. Thus the research scholar through present study found that the 45/60 degree of angle is suggested to be the best for getting optimum stride length at the initial phase after ejecting from the starting block.
- Front Block Angle allows the athlete to acquire a conducive body alignment at the time of leaving the block.
- Front Block Angle plays more determining role than Rear Block with regard to the initial acceleration of the athlete.
Lower Block Angle allows the highest possible force to be produced for the longest practicable time. Therefore it facilitates the athlete in producing the greatest impulse and leaving the blocks with the highest velocity.

Only single combination of block setting not necessarily always will yield the best result.

Different combination will necessarily always not be the determining factor for multiform acceleration ability.

Movement from the Starting Block in the sprint start must not only be fast and forceful but should permit the sprinter to rapidly take up a mechanically efficient running position.

Performance in the 30 m sprint is influenced by a multitude of factors including starting strategy, stride length, stride frequency, physiological demands, biomechanics, neural influences, muscle composition, anthropometrics, and track and environmental conditions.

The sprint start, the accelerative phase of the race, depends greatly on muscular power. Three considerations of the sprint start are reaction time (time to initiate response to the sound of the starting gun), movement time (onset of response until end of movement) and response time.

Maximal velocity running is a result of stride length and stride frequency. While stride length can be greatly limited by an individual’s size and joint flexibility, stride frequency can be affected by muscle composition, neuromuscular development, and training.

100 m sprint world record times have progressed drastically; there is limited evidence for how technology has contributed to such improvement. As such, human physiology and physique combine to be the most influential determinants of improved sprint performance.