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BIOMECHANICAL ANALYSIS OF PROPULSION PHASE OF LOW DRIBBLE IN BASKETBALL

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Abstract

Aim: The study was concluded in order to the biomechanical analysis of population phase of low dribble in basketball players. **Subjects:** Twenty randomly selected male students aged 17-28 years and who have participated in North Zone Inter University Basketball Championship 2010-11 held at CSJMU Kanpur were selected as subjected for the study. ***Methods***: With the help of Casio High Speed Camera (300 F/s) was used to film the subjects is sagital plane of low dribble. Siliconcoach Pro 7 Software was used in order to obtain the values of selected angular kinematics variables Ankle Joint(right), Knee Joint(right), Hip Joint(right) Shoulder joint(right), Elbow joint (right) and Wrist joint (right) from develop stick figures feature. **Statistic:** The Descriptive statistics and The Pearson's product moment correlation coefficient were used to measure the relationship between selected biomechanical variables with the performance of low dribble. The level of significance was set at 0.05. ***Conclusion:*** The angle of Knee joint in propulsion phase was significantly influences the performance of low dribble.

key wards:- Biomechanical analysis, Basketball and Low Dribble

Introduction

Biomechanics may be defined as the science, which investigates the internal and external forces acting on a human body and the effects produced by these forces. In the last several decades, biomechanics has demonstrated considerable growth evolving from an exercise in the filming of human movement to an applied science with a powerful array of measurement and modeling techniques. The simple descriptive approach which was characteristic of early work has been superseded by attempts to explain the mechanisms underlying movement. Consequently, biomechanics has emerged as an important area of scientific investigation in a variety of disciplines. Included among these are automobile safety, biomedical engineering, ergonomics, exercise science, orthopedic surgery, physical rehabilitation, and sport.

Cinematography is the technique most frequently used in sport biomechanics research for obtaining a record of human movement. These film records are quantitatively analysed to obtain linear and angular displacement time data for total body or segmental movements. Typically, the basic displacement time functions of a motion do not provide sufficient information to describe fully the activity thus; these data are further treated mathematically to determine the respective velocity and acceleration functions.

The role of cinematography in biomechanical research involved from a simple form of recording motion to a sophisticated means of computer analysis of motor efficiency. Over the years, new techniques in filming and timing having been perfected to aid the research in achieving accurate time measurements of both simple and complex locomotion patterns .

Basketball is a game of intricate movement combined with great speed and accuracy. The meshing of fundamentally sound players weaving clever patterns of attack and defense develops great teams. The spectator realizes this subconsciously but in many cases cannot recognize it. Shooting which is an evaluation of passing will follow and give the greatest satisfaction in execution. It makes little difference how well a team defends, dribbles, and passes to work the ball into a scoring position if the player cannot shoot.

Objective-: The purpose of this study was to the Biomechanical analysis of low dribble at propulsion phase.

Methodology: The study was delimited to male basketball players and who have participated in North Zone Inter University Basketball Championship 2010-11 held at CSJMU Kanpur were selected as subjected for the study. With the help of Casio High Speed Camera (300 F/s) was used to film the subjects is sagital plane of low dribble. The study was further delimited to the 20 subject belonging to the age group 17 to 28 years. The subjects were right and left handed players.

Photograph-1 Low dribble at propulsion phase

The scores of the subjects in low dribble were used as the criterion variable in the study. Silicon coach pro 7software was used for biomechanical analysis of low dribble in basketball. A Casio Exilim F-1 High Speed Camera, which was positioned at 7.90m from the subject at a height of 1.50mts. from the subject on an extension of free throw line in centre. Camera was also set for capturing 300 fps. The selected kinematical variables of the body were calculated at propulsion phase.

The videos as obtained by the use of digital videography were analyzed (the best trial) by silicon coach pro 7 software. Only one selected frame was analyzed. Selected variables were as under Ankle joint, Knee joint, Hip joint, Shoulder joint, Elbow joint, Wrist joint and Height of Centre of gravity. The data was analyzed by use of Descriptive statistics.

RESULTS

Table - 1
Descriptive Analysis of Low Dribble at Propulsion Phase- 1 in Basketball

	Ankle	Knee	Hip	Shoulder	Elbow	Wrist
Mean	78.35	122.85	142.20	13.35	76.70	153.95
Std. Deviation	9.47	7.92	16.81	7.20	11.46	11.45
Range	31.00	27.00	53.00	24.00	39.00	36.00
Minimum	61.00	110.00	112.00	5.00	54.00	136.00
Maximum	92.00	137.00	165.00	29.00	93.00	172.00

(all angular variables were measured in degrees)
(N= 20)

Table- 1 reveals the descriptive analysis of low dribble at propulsion phase- 1 in Basketball, the angle of right ankle joint, right knee joint, right hip joint, right shoulder joint, right elbow joint and right wrist joints mean and SD values were 78.35 ± 9.47; 122.85 ± 7.92; 142.20 ± 16.81; 13.35 ± 7.20; 76.70 ± 11.46 and 153.95 ± 11.45 respectively. The minimum and maximum values of the angle of right ankle joint, right knee joint, right hip joint, right shoulder joint, right elbow joint and right wrist joints were 61 & 92, 110 & 137, 112 & 165, 05 & 29, 54 & 93 and 136 & 172 respectively.

The graphical representation of angular kinematic variables of low dribble at propulsion phase- 1 in Basketball has been presented in figure 2.

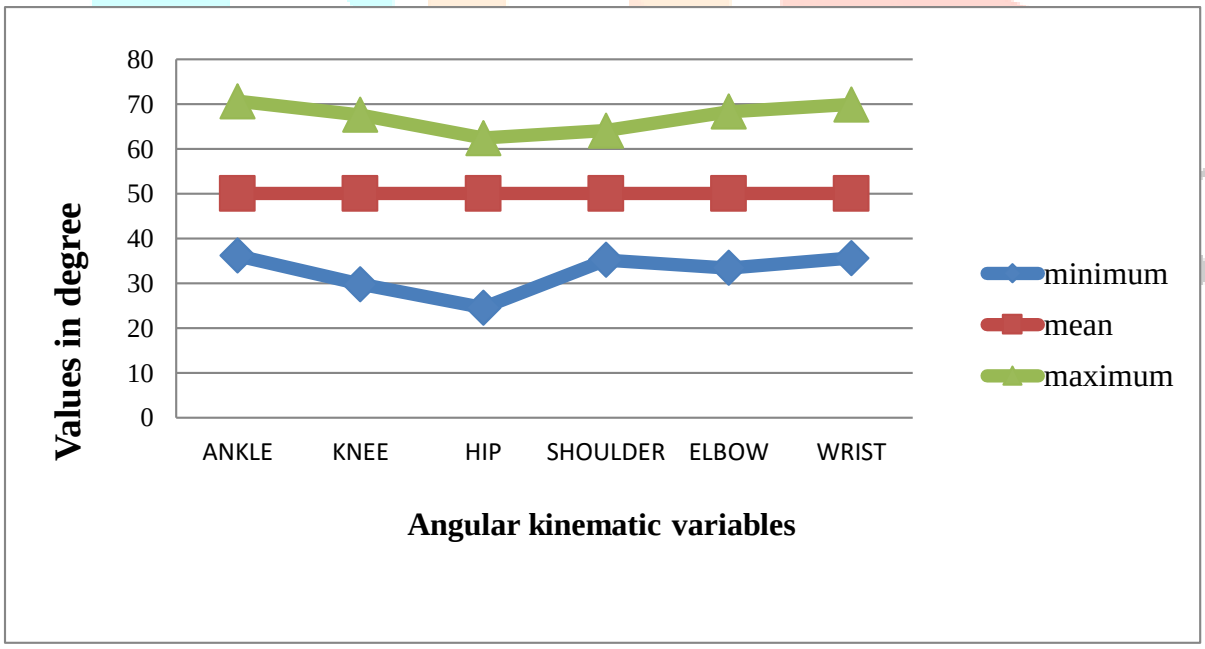

Figure 2: Profile chart of angular kinematic variables of low dribble at propulsion phase- 1 in Basketball

Table - 2
Correlation between Dependent Variable (*Low dribble performance*) and Independent Variables (selected angular kinematic variable*)*
at moment propulsion phase -1

Independent Variables	Correlation coefficient
Ankle joint (Right)	-0.037
Knee joint (Right)	-0.488*
Hip joint (Right)	-0.098
Shoulder joint (Right)	-0.146
Elbow joint (Right)	-0.255
Wrist joint (Right)	0.113

* Significant at .05 level
r.05 (18) = .444

Table - 2 clearly indicates that there exists a significant relationship between *low dribble performance and knee joint (right)* as the correlation coefficient values were found higher than the tabulated values at .05 level of significance.

On the other hand, there exists an insignificant relationship between *low dribble performance and ankle joint (right), hip joint (right), shoulder joint (right), elbow joint (right) & wrist joint (right)* as the correlation co-efficient values were found lower than the tabulated values at .05 level of significance.

Table - 3
Descriptive Analysis of Low Dribble at Propulsion Phase 2 in Basketball

	Ankle	Knee	Hip	Shoulder	Elbow	Wrist
Mean	75.85	116.15	135.80	13.70	89.30	149.20
Std. Deviation	8.41	11.82	13.79	4.66	22.30	21.18
Range	23.00	43.00	44.00	18.00	90.00	90.00
Minimum	62.00	93.00	112.00	5.00	29.00	82.00
Maximum	85.00	136.00	156.00	23.00	119.00	172.00

(all angular variables were measured in degrees)
(N= 20)

Table- 3 reveals the descriptive analysis of low dribble at propulsion phase- 2 in Basketball In this the angle of right ankle joint, right knee joint, right hip joint, right shoulder joint, right elbow joint and right wrist joints mean and SD values were 75.85 ± 8.41; 116.15 ± 11.82; 135.80 ± 13.79; 13.70 ± 4.66; 89.30 ± 22.30 and 149.20 ± 21.18 respectively. The minimum and maximum values of the angle of right ankle joint, right knee joint, right hip joint, right shoulder joint, right elbow joint and right wrist joints were 62 & 85, 93 & 136, 112 & 156, 05 & 23, 29 & 119 and 82 & 172 respectively.

The graphical representation of angular kinematic variables of low dribble at propulsion phase- 2 in Basketball has been presented in figure 3.

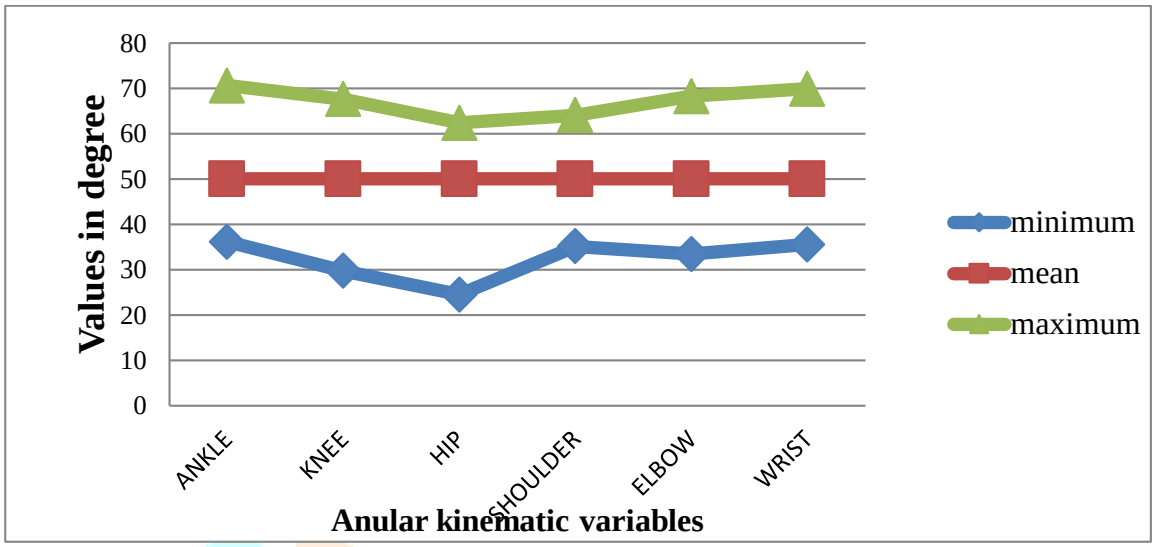

Figure 3: Profile chart of angular kinematic variables of low dribble at propulsion phase- 2 in Basketball

Table - 4
Correlation between Dependent Variable (*low dribble performance*) and Independent Variables (selected angular kinematic variable)
at moment propulsion phase -2

Independent Variables	Correlation coefficient
Ankle joint (Right)	-0.233
Knee joint (Right)	-0.419
Hip joint (Right)	0.156
Shoulder joint (Right)	-0.282
Elbow joint (Right)	-0.297
Wrist joint (Right)	0.163

* Significant at .05 level
r.05 (18) = .444

Table - 4 clearly indicates that there exists an insignificant relationship between *low dribble performance and ankle joint (right), knee joint (right), hip joint (right), shoulder joint (right), elbow joint (right) & wrist joint (right)* as the correlation co-efficient values were found lower than the tabulated values at .05 level of significance.

Table - 5
Descriptive Analysis of Low Dribble at Propulsion Phase 3 in Basketball

	Ankle	Knee	Hip	Shoulder	Elbow	Wrist
Mean	74.75	119.30	127.55	14.35	104.20	149.75
Std. Deviation	8.54	11.43	15.84	6.37	14.39	13.43
Range	27.00	57.00	64.00	20.00	50.00	45.00
Minimum	61.00	88.00	86.00	5.00	83.00	124.00
Maximum	88.00	145.00	150.00	25.00	133.00	169.00

(all angular variables were measured in degrees)
(N= 20)

Table- 5 reveals the descriptive analysis of low dribble at propulsion phase- 3 in Basketball In this the angle of right ankle joint, right knee joint, right hip joint, right shoulder joint, right elbow joint and right wrist joints mean and SD values were 74.75 ± 8.54; 119.30 ± 11.43; 127.55 ± 15.84; 14.35 ± 6.37; 104.20 ± 14.39 and 149.75 ± 13.43 respectively. The minimum and maximum values of the angle of right ankle joint, right knee joint, right hip joint, right shoulder joint, right elbow joint and right wrist joints were 61 & 88, 88 & 145, 86 & 150, 05 & 25, 83 & 133 and 124 & 169 respectively.
The graphical representation of angular kinematic variables of low dribble at propulsion phase- 3 in Basketball has been presented in figure 4.

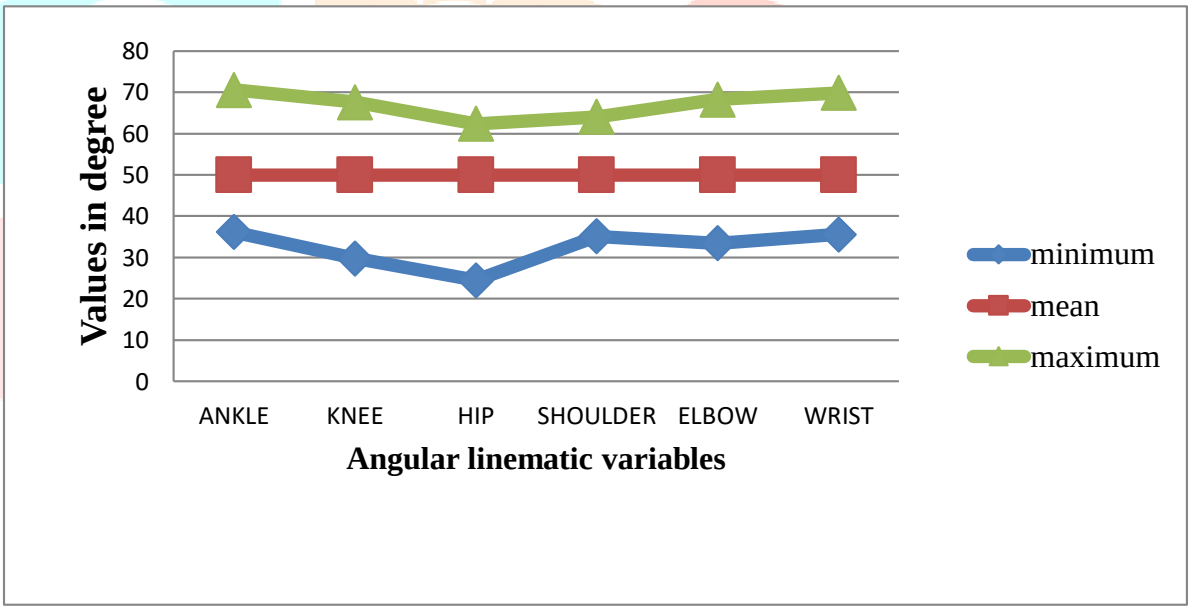

Figure 4: Profile chart of angular kinematic variables of low dribble at propulsion phase- 3 in Basketball

Table - 6
Correlation between Dependent Variable (*low dribble performance*) and Independent Variables (selected angular kinematic variable*)*
at moment propulsion phase -3

Independent Variables	Correlation coefficient
Ankle joint (Right)	0.060
Knee joint (Right)	-0.331
Hip joint (Right)	-0.083
Shoulder joint (Right)	-0.277
Elbow joint (Right)	-0.377
Wrist joint (Right)	0.069

* Significant at .05 level
r.05 (18) = .444

Table - 6 clearly indicates that there exists an insignificant relationship between *low dribble performance and ankle joint (right), knee joint (right), hip joint (right), shoulder joint (right), elbow joint (right) & wrist joint (right)* as the correlation co-efficient values were found lower than the tabulated values at .05 level of significance.

Table - 7
Descriptive Analysis of Low Dribble at Propulsion Phase 4 in Basketball

	Ankle	Knee	Hip	Shoulder	Elbow	Wrist
Mean	74.40	111.35	125.65	24.55	127.40	164.55
Std. Deviation	9.30	10.18	15.14	10.68	12.63	6.13
Range	29.00	41.00	65.00	35.00	48.00	24.00
Minimum	60.00	84.00	86.00	7.00	106.00	150.00
Maximum	89.00	125.00	151.00	42.00	154.00	174.00

(all angular variables were measured in degrees)
(N= 20)

Table-7 reveals the descriptive analysis of low dribble at propulsion phase- 4 in Basketball, the angle of right ankle joint, right knee joint, right hip joint, right shoulder joint, right elbow joint and right wrist joints mean and SD values were 74.40 ± 9.30; 111.35 ± 10.18; 125.65 ± 15.14; 24.55 ± 10.68; 127.40 ± 12.63 and 164.55 ± 6.13 respectively. The minimum and maximum values of the angle of right ankle joint, right knee joint, right hip joint, right shoulder joint, right elbow joint and right wrist joints were 60 & 89, 84 & 125, 86 & 151, 07 & 42, 106 & 154 and 150 & 174 respectively.

The graphical representation of angular kinematic variables of low dribble at propulsion phase- 4 in Basketball has been presented in figure 5.

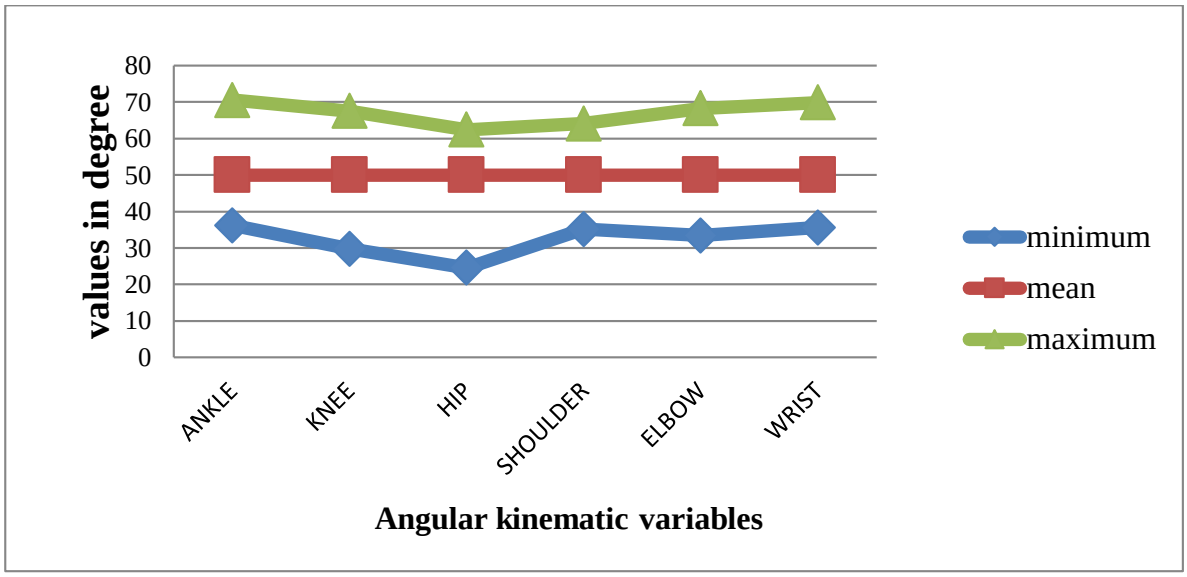

Figure 5: Profile chart of angular kinematic variables of low dribble at propulsion phase- 4 in Basketball

Table - 8
Correlation between Dependent Variable (*low dribble performance*) and Independent Variables (selected angular kinematic variable*)*
at moment propulsion phase -4

Independent Variables	Correlation coefficient
Ankle joint (Right)	0.095
Knee joint (Right)	-0.191
Hip joint (Right)	-0.132
Shoulder joint (Right)	0.195
Elbow joint (Right)	0.225
Wrist joint (Right)	0.007

* Significant at .05 level
r.05 (18) = .444

Table - 8 clearly indicates that there exists an insignificant relationship between *low dribble performance and ankle joint (right), hip joint (right), shoulder joint (right), elbow joint (right) & wrist joint (right)* as the correlation co-efficient values were found lower than the tabulated values at .05 level of significance.

Discussion of Finding

The values of coefficients of correlation of selected angular kinematics variables at propulsion phase- 4 in low dribble were: right ankle joint (0.095), right knee joint (-0.191), right hip joint (-0.132), right shoulder joint (0.195), right elbow joint (0.225), right wrist joint (0.007). The elbow should be extended down as much as possible to shorten the distance the ball has to travel and to be more in control.

The results of the study shows that the majority of angle variations were found in lower extremity joints hip and knee whereas joints of upper extremity specifically elbow joint show more variation in comparison to shoulder and wrist. The contribution of hip joint, knee joint & elbow joint are required for the best execution of low dribble. These joints are very important for the execution of low dribble because slight bending of lower body leads to stability and allows the player to move quickly and accurately in desired direction, while extension of elbow downwards as much as possible is required to shorten the distance the ball has to travel and more control in dribbling

The results obtained in this research were found interesting. Appearance of such results is quite obvious because the technique of different skills of basketball is different and nature of take-off varies.
It may be due to the fact that any skill execution in basketball is not solely dependent on one joint movement, it is the combination of movements at different joints.

Conclusion

1. The angular kinematic variables such as right ankle joint, right knee joint, right hip joint, right shoulder joint, right elbow joint and right wrist joint did not have a significant relationship with the performance of low dribble at propulsion phase- 1.
2. The right knee joint had a positive contribution on the performance of low dribble at propulsion phase- 2.
3. The angular kinematic variables such as right ankle joint, right hip joint, right shoulder joint, right elbow joint and right wrist joint did not have a significant relationship with the performance of low dribble at propulsion phase- 2.
4. The angular kinematic variables such as right ankle joint, right knee joint, right hip joint, right shoulder joint, right elbow joint and right wrist joint did not have a significant relationship with the performance of low dribble at propulsion phase- 3.
5. The angular kinematic variables such as right ankle joint, right knee joint, right hip joint, right shoulder joint, right elbow joint and right wrist joint did not have a significant relationship with the performance of low dribble at propulsion phase- 4.

Discussion of Hypothesis

1. The hypothesis stated earlier that there would be no significance relationship between angular kinematic variables at the performance of basketball were partially accepted and partially rejected.

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