p- ISSN: 2708-2113 **e-ISSN:** 2708-3608 **L-ISSN:** 2708-2113
URL: http://dx.doi.org/10.31703/gesr.2019(IV-I).03 **DOI:** 10.31703/gesr.2019(IV-I).03
Vol. IV, **No.** I (2019) **Pages:** 21 – 25

Kinematical Analysis of Off-Spin Bowling at Club level Cricket

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Abstract: *Cricket is the most famous game but no research work in cricket in the field of biomechanics. The aim of study was to find out the relationship of body segments angles, height of release, angle of release and average speed with deviation of ball. Eight males off spin bowlers has to bowl six legal deliveries. Descriptive statistics was used for describing the data. Pearson product moment correlation was used for the various relationship of the variable to the deviation of the ball. Angle of release (r=0.895**), average velocity (r=0.852), ankle joint left (r=.604), knee joint left (r=0.642), shoulder joint left (r=-.610) and elbow joint left (r=-.694) were significantly correlated to the deviation of the ball. Result shows that the balls bowled by bowlers with greater angle of release, on higher speeds and with extended left ankle angle were deviate more. Ball deviate more with lesser left shoulder and elbow angles.*

Key Words: Kinematics Analysis, Cricket, off-Spin Bowling, Deviation, Club Level.

Introduction

Cricket is most famous game in Pakistan that connects the people around whole country. Roots of cricket in Pakistani society are very deep and vibrant. It brings people of Pakistan closer socially and culturally. According to experts, matches are won mostly by bowlers. Bowlers are either spin or fast. Spin bowlers' plays vital role in the success of a team. Top three wicket taking bowlers in test match format are spin bowlers as well as in one-day cricket, highest wicket getter was also spin bowler (Goswami *et al*., 2016). Finger spin and wrist spin are two types of spin bowling. Off spin bowlers falls in the category of finger spin bowlers. As compared to the fast bowler, spin bowlers rely on tactics and deception to get wickets. Spin bowlers deviates the ball from its original path by producing rotational movement on the ball with speed mostly in between 70 -90 km/h (Goswami *et al*., 2016). Deviation can be in air or off the ground, depends on the skill of spin bowler (Woolmer, 2009).

A case study by Lloyd et al. (2000) on Muttiah Muralitharan quantified some facts about off spin bowling. Mostly the off-spin bowlers have a shorter stride length than leg-spinners. Ferdinands & Kersting, 2007 reported that Illegal bowling actions have relation to elbow extension and angular velocity. Identified kinematical variables of off spin bowlers were analysed by Chin et al. (2009).

A lot of factors affect the performance of the off-spin bowler but only few studies were carried on off spin bowling. So, there is need of extensive research. There is lack of research evidence that provide information about how off-spin bowlers' deviate the ball to deceive the batsman at Grass root level. The aim of this study was to find out relationship of height of release, average velocity and body segment angles with deviation of the ball at grass root level in Pakistan.

Methods

Eight male off-spin bowlers from different clubs of Lahore, Pakistan participated in this study. They were amateur played and just played club level cricket. Board of the Study, Department of Sports Sciences and Physical Education, University of the Punjab, Pakistan given the approval for this study. Subjects were informed about testing protocols and consent was taken from subjects. Ten-minute warm-up was done by the participant of their own choice. Six practice deliveries were bowled by every bowler to get use to the testing scenario. Every bowler bowled six legal deliveries with extreme effort and only good length

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(11.5 – 14.5 m marked on pitch) ball were recorded for analysis. Specification of ball was 0.156± 0.163 kg mass and 0.224± 0.229 m circumference. Biomechanical analysis of off spin bowling was carried out by filming the outdoor bowling action test of all subjects on video. Three video cameras (60 frames per second) were used at different position showed in Fig.1 and identified biomechanical variables were calculated by following the procedure of Gosawami et al., 2016. To analyze and digitize the recorded videotapes, motion analysis system (Kinovea Software; 0.8.15) was used in fig.2.

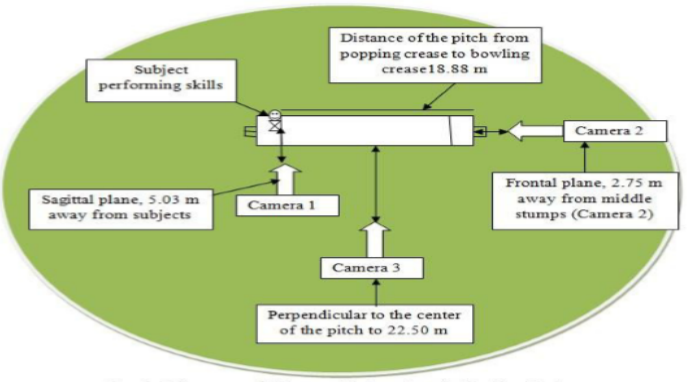

Fig 1: Camara Positioning and Experimental Setup Following the Procedure of Gosawami et al., 2016.

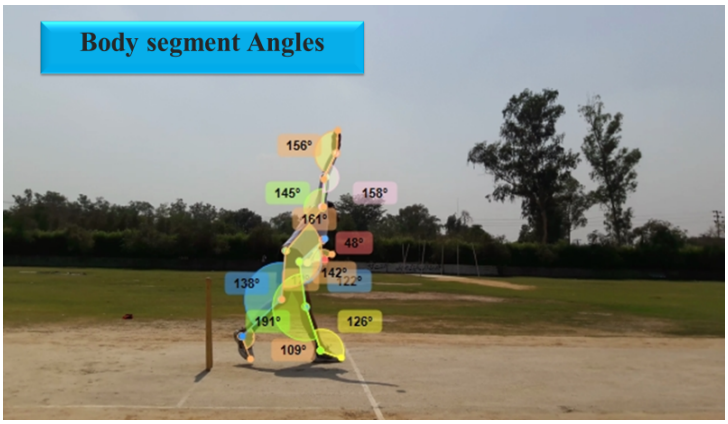

Fig 2: Athlete Body Segment Angles.

Collected numerical data in raw form was examined by firstly arranged serially, then tabulated and later analyzed statistically by using IBM SPSS 22. For describing the data, Descriptive statistics was used. Pearson's Product Moment Correlation was used to find out the relationship of selected variable with deviation of ball.

Results

Table 1. Descriptive Statistics of Identified Variables of Off Spin Bowlers

Variable	Range	Min.	Max.	Mean	S. D	Skewness
Height of Release (cm)	22.83	156.3	179.1	168.49	8.91	-.126
Angle of Release (Degree)	4.00	6.00	10.00	7.64	1.43	.288
Average Velocity (m/s)	2.80	14.50	17.30	16.01	1.01	-.013
Ankle Joint Right (Degree)	20	99	119	110.00	5.78	-.182
Knee Joint Right (Degree)	35	111	146	124.64	11.55	.429

Hip Joint Right (Degree)	25	141	166	153.45	7.94	.466
Shoulder Joint Right (Degree)	51	122	173	143.45	15.56	.262
Elbow Joint Right (Degree)	13	178	191	184.18	3.90	.168
Wrist Joint Right (Degree)	26	144	170	157.82	7.52	-.246
Ankle Joint Left (Degree)	20	106	126	118.73	6.50	-1.328
Knee Joint Left (Degree)	33	133	166	152.45	11.60	-.273
Hip Joint Left (Degree)	59	93	152	120.18	16.96	.308
Shoulder Joint Left (Degree)	32	12	44	21.45	8.34	2.163
Elbow Joint Left (Degree)	37	110	147	130.18	13.89	-.020
Wrist Joint Left (Degree)	53	115	168	144.36	20.34	-.072

Table 2. Correlation Values of Identified Variables with Lateral Deviation.

Variables	**Lateral Deviation**
Average Velocity	.852**
Angle of Release	.895**
Height of Release	-.306
Right Shoulder joint Right	-.001
Right Elbow joint Right	.004
Right Wrist Joint Right	.037
Right Ankle Joint Right	.361
Right Knee Joint Right	.028
Hip Joint Right	.027
Shoulder joint Left	-.610*
Elbow joint Left	-.694*
Wrist Joint Left	-.510
Knee Joint Left	.642*
Hip Joint Left	.169
Ankle Joint Left	.604*

The relationship of Angle of Release and Average Velocity with lateral deviation of the ball was highly significant and positive with values of 0.895 and 0.852 respectively. No right side body segment angle was insignificant correlated with deviation of ball. The relationship of Ankle Joint Left and Knee Joint Left was positive and significant with deviation. Elbow Joint Left and Shoulder Joint Left had negative and significant relationship with deviation.

Discussion

Results show that deviation of the ball had a highly significant relationship with Angle of Release. The results also reveal that ball with greater angle of release deviate more than other. It means that when bowler bowls with extended elbow which enhance the flight, the balls will deviate more than normal. Average velocity also played an important role in the deviation of the ball as it was obvious from the Table 1. Lateral deviation of the ball has significant, high and positive correlation with Average Velocity. Balls bowled with higher velocity by the off spin bowler got more lateral deviation of the ball and vice versa. Internal rotation of upper arm at the shoulder is required the flexion at the elbow joint right plays a vital and significant role to generate the velocity of the ball (Marshall & Ferdinands, 2003) which contributes in the lateral deviation of the ball. This study was on club level bowlers, so a great variation was found due to lack of technique, coaching, facilities and grass root level players. There was no significant relationship between the right side body angles and deviation of the ball. It shows that they have insignificant contribution towards the deviation.

It is also evident from the results that ankle joint left has positive and significant (.604*) correlation with the lateral deviation of the ball. Ball deviation would be increased if ankle joint left angle was on the higher side. Knee joint left also contributed in lateral deviation of the ball significantly (.642). It had

significant correlation with the ball deviation. In the cases of higher angle of knee left joint, ball deviation was also on the higher side. Height of release was increased as knee and hip angles increases (Foster et al. 19 89). More top-spin on the ball was produced by increased height of release but less deviation off the pitch. It creates more dips in flights which deceive batsman during flight. So, increased height of release contributes towards the performance of off spin bowler.

Shoulder joint left had a negative and significant relation (-.610) with lateral ball deviation of the ball. Elbow joint left with mean and standard deviation of 130.18±1.89, range was 37, it showed significant and negative correlation (-.694) with lateral deviation of the ball. It was evident from results that if elbow joint is smaller than spin rate will be on higher side. The results of the study were in line with the study of Goswami et al., 2016 which is done on University level bowlers.

Conclusion

This study shows that balls bowled by off spin bowlers with greater angle of release, on higher speeds and with extended left ankle angle were deviate more. Ball of off spin bowlers deviate more with lesser left shoulder and elbow angles. This study concludes that performance of spin bowler can be enhanced by optimizing different body segment angles, angle of release and Average Velocity of the ball. Coaches can use result of this study to improve the performance of their bowlers

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