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The Impact Of Wide Balls On The Results Of T-20 International Cricket

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Abstract:
This study examines the impact of wide balls on T-20 cricket matches, analyzing data from post-COVID-19 fixtures including World Cup, Asia Cup, and series games. Data collection utilized a detailed proforma to record each wide ball's occurrence and associated factors. Wide balls contributed about 13% to runs margin and 30% The balls remaining margin. Fast bowlers, particularly fast-medium types, were most likely to deliver wide balls, predominantly on the leg side. Statistical analysis showed significant differences in wide ball frequencies between innings and match types, with tournament matches displaying more cautious bowling. The study highlights the substantial role of wide deliveries in match outcomes and strategic adjustments based on the type of match and bowler characteristics.

Keywords: T-20 cricket, Wide ball, Factors, ANOVA, Chi-Square,

1.Introduction:

The role of Statistics is a necessary part of every field of science. It is a science that deals with gathering data, describing any given phenomenon, presenting, analyzing, and drawing conclusions during the phase of uncertainty. Today, statistics plays a significant role in fields like business, biology, agriculture, psychology, astronomy, sports etc. Analysis of the prior data offers advantageous basis for future projection and helps in effective planning and obtaining optimum benefits (Gupta and Kapoor, 2007). An athlete's historical performance data can be used to make predictions about future sporting events. In sports games such as football, basketball, hockey and cricket etc. past records can be used to make future prediction regarding teams as well as players. In cricket, a team's record in previous matches can be used to forecast their future athletic endeavors, including batting, bowling, fielding, and overall performance. Such empirical or statistical models can be used to design a match strategy before or even while it is in progress to win the match. Team performance varies due to various factors such as team combination, playing tactics and illegal deliveries (extras) specially in crucial situation etc. Cricket is one such sport that makes extensive use of numerous statistical techniques to evaluate both player and match performance aspects. (Daniyal et al., 2014)
The rules of a twenty20 match are similar to those of a one-day match, but the match is much shorter. In this case, the first-batting side must score within 20 overs rather than 50, but they still have to post a score. After then, the other team needs to catch up to that score before everyone is out at the conclusion of the 20 over limit or at the crease. In case of a tie, a Super Over is used to choose a winner. (Astbury, 2023)
Teams in T-20 cricket play fast-paced, high-intensity matches where they have just 20 overs to hit as many runs as they can. In T20Is, batsmen frequently take a more aggressive approach in an effort to score boundaries and increase the run rate. Batsmen often display a variety of creative shots, such the scoop or switch-hit, to keep the opponent guessing. To keep the batsman guessing, bowlers in Twenty20 Internationals adopt a combination of pace changes, spin, and misleading deliveries. Fielders are positioned deliberately by captains to restrict boundaries and put pressure on the batsman. Some of the greatest power batters in the world, capable of effortlessly clearing boundaries, are present in T20Is. T20 Internationals' shortened format provides exciting, action-packed events that keep fans entertained. (What Are The Different Formats Of Cricket, 2024)
Due to the shortened format, various big and small factors have influence on the match result. But genuinely a single score may alter the outcome of match that may gained by the batsmen or by wrong delivery by the bowlers known by extras that comprises mainly on wide balls and no balls.

1.1. Wide Balls:

Wide deliveries are ones that are bowled much beyond the reach of the hitter. If a ball travels outside the popping crease's tram marks without making contact with the bat, it is deemed wide. In games with a limited number of overs, balls that veer to the leg side are also immediately deemed wide. (Extras in cricket, 2021)

1.2.Wide balls rules in different formats in cricket

- Depending on the cricket type being played, there may be slight differences in the rules related to wide deliveries.

- In test cricket matches, when the umpire determines whether a player could have hit the ball with an everyday shot, standard law is in effect.
- Cricket is played in shorter formats, such One Day and T20s, when rules are more strictly enforced and extra lines are painted on the pitch to make it easier to comprehend when a wide is called. (Chatt , 2023)

1.3. Impact of wide balls on the batting team and the overall match

The batting side has more chances to score when the ball is wide. If they are unable to play a stroke, batsmen can either score runs off wide deliveries or earn extras. It can also interfere with the rhythm of the bowler, allowing batters to take advantage of errant deliveries. Wide balls result in additional runs, which can help teams score more points. These extra runs have the potential to change the outcome of the game, particularly in limited-overs styles where each run counts.

2. Literature Review:

Batterham and Hopkins (2006) investigated the factors that affect batting and bowling performance in a T-20 game. According to the study, strike rate, average, runs partnership, and hitting more boundaries can all be used as indicators of batting performance. The study came to the conclusion that longer bowling spells, maimed overs, spin overs, and taking more wickets all affect bowling performance. Sharma (2013) used factor analysis on a dataset of 85 batsmen and 85 bowlers from the Indian Premier League (IPL-2012) to examine the systematic covariation among several parameters relevant to batting and bowling talents of T-20 cricket. The study came to the conclusion that bowling was subordinated to batting abilities. Bhattacharya et al. (2011) discussed the shortcomings of the Duckworth-Lewis approach in T20 cricket matches. The Duckwroth-Lewis method, devised by the authors, is a technique for resetting targets in T-20 cricket matches that are interrupted by rain. After reviewing the DL technique table, a substitute for the DL table is provided. Utilizing observed scores from international T-20 cricket matches, the substitute DL table is created. As a result, the author used all T-20 international cricket matches played by ICC-registered nations between February 2005 and November 2009 in order to model the data. Gibbs sampling in conjunction with isotonic regression analysis applied to observed scores was also used in order to provide a nonparametric alternative resource table. The necessary alternate resource table is monotonic in rows and columns, with overs and wickets corresponding to each other. Given that T20 cricket involves more intense and technical batting than ODI cricket, it is expected that the ensuing resource table will have more rational elements.

Wickramasinghe, I.P. (2014) predicted how batsmen will do in tests of cricket. One of the team sports practiced at various levels in more than 50 nations is cricket. Although it is simple to quantify each batsman's performance for the team, predicting player performance is difficult. This study illustrated a strategy for predicting a cricket batsman's performance throughout the course of a test-match series. Longitudinal test cricket data were gathered for this study over a five-year period. The performance of the player is predicted using a model that takes into account several aspects of the player, the team, and the match series. A three-step hierarchical linear model is suggested in this inquiry due to the hierarchical nature of the data acquired from crickets. The analysis's findings indicate that the ranking of the club and the player's (batsman's) handedness have a big impact on how well a player performs. Finally, the developed model is used to make a precise prediction of player performance. Asanka in 2014. said that in cricket, it's a prevalent assumption that a few additional deliveries in an over will cost the bowling team more than the batting team. The purpose of this research report is to confirm the aforementioned claim. Numerous parameters were found, and the purpose of this study is to confirm which are the primary determinants that would impact the additional delivery outcome. In addition to the conventional statistical analysis, data warehousing and data mining techniques will be applied. Data study revealed that the state of the team cricket will have a greater impact on the outcome of the extra delivery than individual considerations. Peterson et al. (2007), stated that having a higher run rate, taking more wickets during the match, and getting more wickets in the final six overs were the three best measures of IPLT20 success. Since all players are required to field, MacDonald et al. (2013) claim that fielding is a negative performance indicator in cricket. The analysis of performance factors that have the biggest impact on international Twenty20 cricket was conducted by Scott Irvine and Rodney Kennedy. Hughes and Bartlett (2002) define a performance indicator as a selection, or combination of action variables that aim to define some or all aspects of a performance.

Batting and bowling performance indicators used within the game of cricket and applicable to this study includes: total runs, batting average, batting strike rate, fours, sixes, wickets taken, bowling average, strike rate and economy rate (Manage & Scariano, 2013). Farooq et al. (2021) investigated that the test match structure in cricket from a qualitative perspective. The goal of the study is to determine the reason or reasons behind the test format's lower audience and sales. Three distinct cricket formats are critically analyzed in this study: test, one-day, and t-twenty forms. This study revealed that the t-twenty and one-day match forms, the audience finds the test format to be less appealing due to its longer duration. And it will be beneficial to scholars and novices with a keen interest in cricket. Bhattacharjee and Pahinkar (2012) explained that in cricket, bowling and batting have traditionally been the two most crucial parts of the game. The bowlers' job is thought to have become more challenging with the introduction of the newest version of cricket, which plays twenty overs per side. The aim of the study is to determine the performance of the bowlers. This study concluded that the two biggest factors influencing a bowler's performance in the fourth IPL edition are their combined bowling rate and experience in Twenty20 internationals. Phillips et al. (2012) stated that under three distinct work situations, the link between accuracy and performance variability in cricket fast bowlers of varying skill levels was examined. In order to see if bowlers might adjust their movement patterns to preserve performance accuracy during a bowling skills test, bowlers with varying ability levels were tested. It also clarified that how top performance in fast bowling was primarily attributed to accuracy and adaptive variability, both of which increased with skill level. Only national top bowlers demonstrated the necessary degrees of adaptive flexibility in this study to be able to bowl a variety of lengths to various pitch positions. McNamara et al. (2017) explained that there are three distinct formats that each have differing effort requirements, cricket holds a unique place in the world of professional sports. The main aim of the study

is to illustrate the degree to which workload influences performance and injury in elite fast bowlers, match-play physiology, workload, and injury are necessary. The study came to the conclusion that the link between fast bowling workload and performance and injury is well established. While tracking fast bowlers' chronic as well as acute workloads is still the best way to determine readiness. Considering the risk of damage in fast bowlers, there are complications that make it challenging to prescribe bowling workloads in a methodical manner. Technological developments to track workloads could provide more light on fast bowlers' workloads and intensity. Shah. (2016), that the variables like batting and bowling averages have been used to assess each player's performance. The batting and bowling performances of cricket players are measured using these statistics. The aimed of this paper is to introduces an indicator that can be used to evaluate the fielding performance of cricketers. This study concluded that whether playing Twenty20 or ODI cricket, the above metrics can be used to rate a player's fielding performance across an extended period of games.

They enable evaluation of each player's average fielding performance. The total fielding performance of a team can then be calculated by adding together the individual fielding performance scores. Scott et al. (2000), Stated that Professional cricket has seen numerous equipment and technological changes in recent years, one of which being the use of white balls in day-and-night matches. The purpose of this study was to imitate slip-catching performance and movement initiation time in professional cricket players under varying lighting conditions and ball colors. The study came to the conclusion that either catching performance or movement initiation time, no significant effects were found for ball color or illumination levels. Within the measured range, neither the ball's color nor its light level predicted slip-catching professional cricket players' performance and initiation periods of movement. Thus, it was determined that professional cricket ball color and lighting modifications had no negative effects on catching performance. Scott et.al (2023) discussed the Shorter competitive forms have replaced Test cricket as the main form of the game. It is suggested that the introduction of T20 cricket has influenced Test cricket and, consequently, the tactical plans that coaches and players should try to adopt, given the substantial player overlap between formats. This study aimed to determine whether certain indicators of performance for Test cricket have changed. Results show that coaches and players should prioritize developing their players' capacity to hit more sixes, raise their run total, and improve strike rotation when hitting. Twomey et.al (2011) explained that the study's objective is to determine whether junior cricket injury risk and ground hardness are related. The study came to conclusion that Future, larger-scale research is necessary to clarify whether ground hardness plays a role in the most frequent injury mechanism being struck by the ball because this is still unknown.

Many researchers have investigated various aspects in cricket to explore the effects on the match outcome. An important aspect of wide balls role has not been investigated so far on match outcome. In cricket it is observed that mostly matches are won or lost by small margins of runs as compared to wide balls delivered. Thus, if a control is imposed on delivering the wide balls a team may meet to his victory. Thus, there is a need to investigate a study on wide balls effect on match outcome.

3. Methods and Materials

The main aim of the study is to check the role of wide balls in T-20 cricket. This chapter consist of detailed methodology used for achieving the set objectives of the given study.

3.1.Study Design

To achieve the objectives of the study a sound designed proforma was used to collect the data. Proforma was designed in such a manner that each wide ball delivery of the match is noted and various factors associated with the wide balls and match outcome were gathered. The proforma was consist on three (03) sections i.e. overall match outcome factors, first innings wide balls with associated factors and second innings wide balls with associated factors.

3.2. Data Collection

Data have been gathered from the official website of cricinfo. Ball by ball information of wide ball collected after covid-19(2020-2021).. This study is based on the data observed from all the T-20 matches including world cup, Asia cup, and series matches played after COVID-19, and analyzed to get the in-depth information.

3.3. Statistical Analysis

The collected data were analyzed by using appropriate statistical methods based upon the objective. Firstly, the descriptive statistics were computed for all the observed variables and the results were presented with the help of appropriate diagrams/graphs which include bar chart, multiple bar chart, histogram, and pie chart. Secondly, applying the appropriate test on different variables. The data were analyzed by different tests such as T-test, Chi-square test and ANOVA.

3.4. Chi-Square Technique

χ^2 technique is used to check the dependency of one variable to another variable. For this check we test the null hypothesis that two criteria of classification are independent. For example, winning of the 1st set of the game and the winner of the match are independent.

The data are classified in the form of table having r rows and c columns which is called contingency table. The contingency table contains two or more than two rows and two or more than two columns in which n observation are classified according to two different variables. The two rows show the level of one variable and columns shows the level of another variable. And the simplest form of the contingency table is 2x2 in which there are two rows and two columns. And this data is used for the testing of hypothesis that the variables are independent if the hypothesis is rejected then the two variables will be dependent and we conclude that there is some association between the two variables. We get the observed frequencies by cross tabulation

of two variables and the expected frequences by calculating. The observed frequency denoted by o_{ij} and the expected frequences by e_{ij} where i and j denotes the ith and jth rows and columns respectively.
The formula to be used is

$$\chi^2 = \sum_{i=1}^{r}\sum_{j=1}^{c}\frac{(o_{ij}-e_{ij})^2}{e_{ij}} \quad (1)$$

Chi-square statistics is used for the qualitative type of data and this study have some of the variables of qualitative type of data therefore for those variable chi-square statistic is used. . (Chaudhry & kamal, 2011)

3.5. T-test

A statistical test for comparing the means of two groups is called a t test. It is frequently employed in hypothesis testing to ascertain whether two groups are distinct from one another or whether a procedure or treatment genuinely affects the population of interest. It is a parametric test of difference. In T-test data will be are independent, normally distributed and homogeneity of variances or equal variances.
To compare the means of two groups or pairwise comparison the t-test is used whereas for more than two groups mean comparison the ANOVA test is used. The formula to be used is as

$$\mathbf{t} = \frac{\bar{x}-\mu}{s/\sqrt{n}} \quad (2)$$

Where

- **t =** student's t test
- $\bar{x}$ **=** mean
- **μ =** theoretical value
- **s =** standard deviation
- **n** = number of variables

3.5.1. Independent Sample t-test

When comparing two sample means from unrelated groups, the independent samples t-test is employed. This indicates that various individuals are contributing scores for every group. Finding out if the samples differ from one another is the aim of this test. The formula for independent sample t-test is used as under

$$t = \frac{\bar{x_1}-\bar{x_2}}{\sqrt{(\frac{s_1^2}{n_1}+\frac{s_2^2}{n_2})}} \quad (3)$$

Where

- **t** = Student's t-test
- x_1 = mean of first group
- x_2= mean of second group
- s_1 = standard deviation of group 1
- s_2 = standard deviation of group 1
- n_1= number of observations in group 1
- n_2= number of observations in group 2

3.5.2. Paired sample T-test

We have utilized independent samples to test the hypothesis concerning two means, however there are numerous circumstances in which the two samples are not independent. This occurs when two observations are discovered together because they are related to one another. Either by intention or by nature, pairing happens. When the same unit or person is measured twice at separate times, a phenomenon known as natural pairing takes place. . (Chaudhry & kamal, 2011)
the formula to be used is as

$$\mathbf{t} = \frac{\Sigma(x_1-x_2)}{\frac{s}{\sqrt{n}}} \quad (4)$$

Where

- **t** = Student's t-test
- $x_1 - x_2$ = Difference mean of the pairs
- **s** = standard deviation
- **n** = sample size

3.6. ANOVA

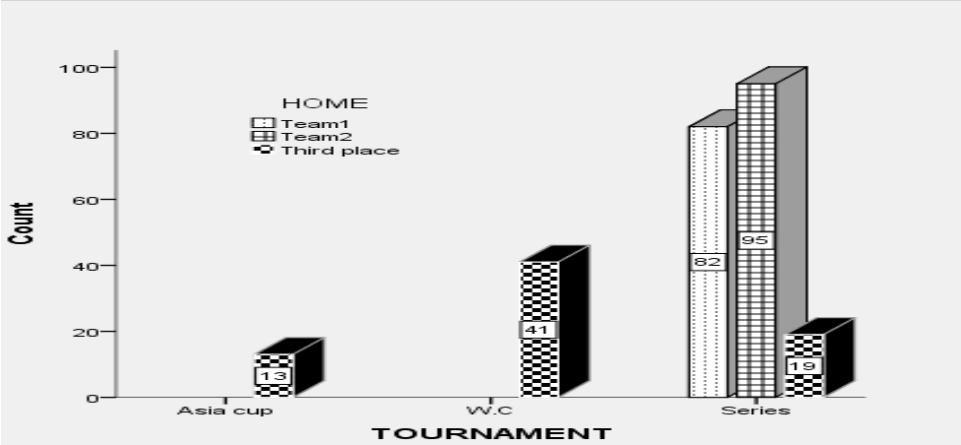
Analysis of Variance is referred to as ANOVA. It is a technique that partitions the total variation into its component parts, each of which is associated with a different source of variation. This statistical technique examines how the means of two or more groups or treatments differ from one another. It is frequently employed to ascertain whether the means of several groups differ in any statistically meaningful ways.

ANOVA contrasts the variation within the groups with the variation between the group means. There may be a considerable difference between the group means if the variation between the group means is significantly greater than the variation within the groups. . (Chaudhry & kamal, 2011)

Analysis if variance table

Source of variation	df	Sum of Squares (SS)	Mean Square (MS)	Computed F
Between Samples	K-1	$r\sum_{j=1}^{k}(\overline{X_{.J}} - \overline{X_{..}})^2 = SSB$	$s_b^2 = \frac{SSB}{k-1}$	$F = \frac{s_b^2}{s_w^2}$
Within Samples (Error)	K-1	$\sum_{j=1}^{k}\sum_{i=1}^{r}(X_{ij} - \overline{X_{.J}})^2 = SSE$	$s_w^2 = \frac{SSE}{n-k}$	
Total	N-1	$\sum_{j=1}^{k}\sum_{i=1}^{r}(X_{ij} - \overline{X_{..}})^2 = SST$	$s_T^2 = \frac{SST}{n-1}$	

4. RESULTS AND DISCUSSION:



Type Figure No.1: Home Team Vs Tournament

In this chapter different statistical tools such as descriptive statistics and various test have been computed on the collected data as described in the section no.3. This section comprises of descriptive statistics and statistical tests.

Figure No.1 shows the cross frequency distribution of Home team and Tournment type played. Team 1 has 82 occurrence and Team 2 has 95 occurrences while 3rd place has 73 occurrence which have both teams (team1 and team 2) played in other countries. Out of total matches Tournament matches are 54 and series matches are 196, with 21.6% classified as "Tournament" and 78.4% as "Series." The occurrence of Asia cup matches is 13, world cup (W.C) has 41, while Series matches has 196 matches.

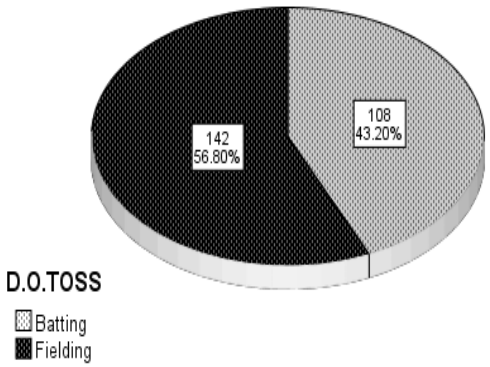


Figure no.2 Winner of Toss

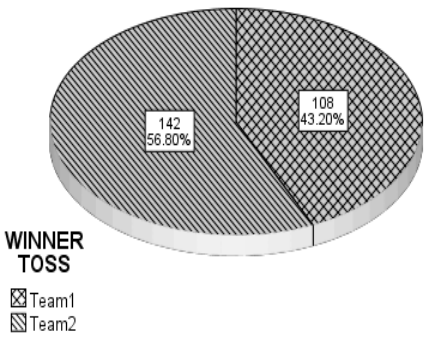


Figure no.3 Decision of Toss

Figure no.2 and no.3 shows winner of toss and Decision of toss of the team 1 and team 2 respectively. The percentage of Winner of toss of Team 2 is 56.80% it's higher than the percentage of Winner of toss of Team 1 which is 43.20 %. While the Decision of Toss bifurcated as 56.80% chose fielding first and 43.20% for batting first.

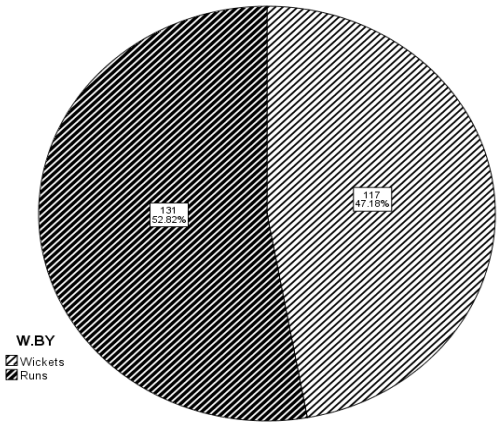


Figure no.4: Matches Win by

Figure no. 4 shows the pie chart of the Win by type of matches, describing that the percentage of win by runs is 52.82% which is higher than the percentage of Wickets which is 47.18%.

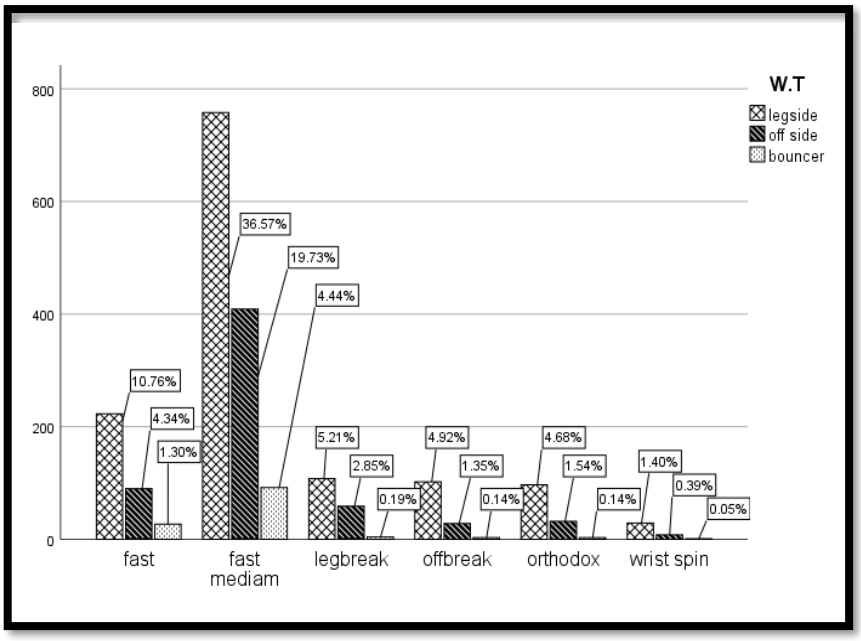


Figure no. 5: Bowler Type and Wide Ball Delivery Type

figure no.5 describe bowler type and wide type percentage. The figure showed that 15% wides are delivered by fast bowlers having leg side wide type majorly. Whereas in this figure the fast medium bowlers having highest percentage around 60% of delivering wide balls majorly leg side and off side in all matches. While 25% wide balls delivered by spin bowlers.

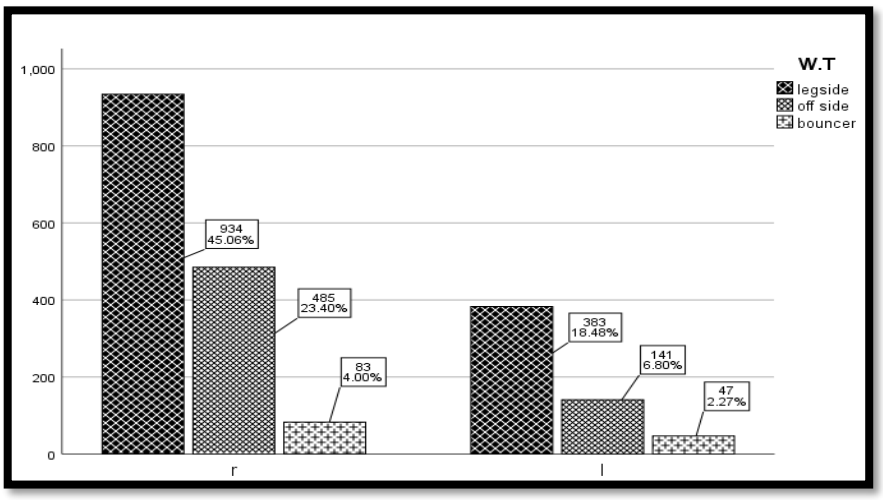


Figure no.6: Bowler Hand and Wide Type

Figure no.6 describe bowler hand and wide type percentage. The figure showed that 26% wides are delivered by left-handed bowlers having leg side wide type majorly. Whereas in this figure the right-handed bowlers having highest percentage around 72% of delivering wide balls majorly leg side and off side in all matches.

Table no.1 shows that the distribution and variability of wide deliveries and balls remaining in the batting second winner of the match and runs of winning margin for the team batting first winning of the match. The mean number of wide deliveries in the first innings, winner of the match is 4.78 while in the second inning is approximately 3.47. whereas for the team losing match in first innings mean no. of wide balls is 3.94 while in the second innings is 4.27 indicating that winner of the first and losing of the second inning are closer, similarly loser of the first inning and winner of the second innings are closer which are lower than the first inning winner and second inning loser respectively. Further the comparison of runs margin and balls remaining margin shows that mean runs are much higher than the mean remaining balls which indicates that team batting second plays according to the target given and approaches target carefully. Thus, the result shows that wide deliveries contributes approximately 13% in runs margin while around 30% contributes in balls remaining margin.

Table no.1: Statistics of 1st and 2nd innings wide balls with respect of winner of the match

	First Innings (Batting Team)				Second Innings (Batting Team)			
	Winner		Loser		Winner		Loser	
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Mean (Percentage of wide balls with respect to runs margin and balls remaining margin)	4.78 (13%)	37.12	3.94 (30%)	12.97	3.47 (27%)	12.97	4.27 (11.5%)	37.12
Std. Error of Mean	.217	2.596	.256	1.285	.191	1.285	.211	2.596
Median	5.00	31.00	3.00	8.00	3.00	8.00	4.00	31.00
Mode	5	4	3	1	3	1	4	4
Std. Deviation	2.509	30.045	2.761	13.843	2.058	13.843	2.438	30.045
Variance	6.295	902.707	7.622	191.634	4.234	191.634	5.942	902.707
Skewness	.368	1.082	1.131	2.120	.479	2.120	.523	1.082
Std. Error of Skewness	.209	.209	.225	.225	.225	.225	.209	.209
Kurtosis	-.291	1.503	1.924	6.815	.452	6.815	-.040	1.503
Std. Error of Kurtosis	.416	.416	.446	.446	.446	.446	.416	.416
Range	12	155	15	87	11	87	11	155
Minimum	0	0	0	0	0	0	0	0
Maximum	12	155	15	87	11	87	11	155
Sum	640	4974	457	1504	403	1504	572	4974

Table no.2: Paired sample T-test of total wide balls of 1st and 2nd inning

			Paired Differences					T-Statistic Value	df	Sig. (2-tailed)
			Mean	Std. Deviation	Std. Error Mean	95% C.I of Difference				
						[illegible]	[illegible]			
Over All		**1st Vs 2nd Innings**	.488	3.224	.204	.086	.890	2.393	249	**.017**
Toss Winner	**Team1**	**1st Vs 2nd Innings**	.537	2.987	.287	-.033	1.107	1.868	107	**.064**
	Team2	1st Vs 2nd Innings	.451	3.403	.286	-.114	1.015	1.578	141	.117
Toss Decision	**Batting**	**1st Vs 2nd Innings**	.537	2.987	.287	-.033	1.107	1.868	107	**.064**
	Fielding	1st Vs 2nd Innings	.451	3.403	.286	-.114	1.015	1.578	141	.117
Match Winner	**Team1**	**1st Vs 2nd Innings**	.507	3.255	.281	-.049	1.064	1.804	133	**.073**
	Team2	1st Vs 2nd Innings	.466	3.202	.297	-.123	1.054	1.566	115	.120
Home Team	Team1	1st Vs 2nd Innings	-.256	2.947	.325	-.904	.391	-.787	81	.434
	Team2	**1st Vs 2nd Innings**	.925	3.461	.335	.262	1.589	2.766	106	**.007**
	Third Place	**1st Vs 2nd Innings**	.721	3.017	.386	-.051	1.494	1.867	60	**.067**
Guest Team	**Team1**	**1st Vs 2nd Innings**	.842	3.416	.350	.146	1.538	2.403	94	**.018**
	Team2	1st Vs 2nd Innings	-.021	3.121	.322	-.661	.618	-.066	93	.947
	Third Place	**1st Vs 2nd Innings**	.721	3.017	.386	-.051	1.494	1.867	60	**.067**

Table no.2 shows the result of paired t-test for the variables wide balls of first inning and second inning of the match and also with the splitting variables, Toss Winner, Toss Decision, Match Winner, Home Team and Guest Team taking under consideration. From the results it has been revealed that there is a significant difference between the wide balls of the first inning and second inning in overall comparison. Further, from the results it has been shown that there is a significant difference between the wide balls of first and second innings where team 1 is the winner of the toss, winner of the toss team opts batting first, team1 is the winner of the match, team 2 is playing as home team, matches played in neutral place, team1 plays as a guest team too.

Table no.3: Statistics of inning wise wide balls in tournaments vs Series matches

	Match Type	N	Mean	Std. Deviation	Std. Error Mean
First Innings Wides	Tournament	54	4.11	2.392	.326
	Series	196	4.46	2.726	.195
Second Innings Wides	Tournament	54	3.43	2.006	.273
	Series	196	4.03	2.362	.169

Table no.3 shows that the group statistics of wide balls inning wise in Tournaments and series matches. Results showed that series matches have higher number of wide balls as compared to the tournaments. This indicates that bowlers are more careful while delivering balls in tournaments as compared to series matches.

Table no.4: Independent sample t-test between Tournament and Series Matches

	t-test for Equality of Means						
						95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
1st Innings vs 2nd Innings	-.865	248	.388	-.353	.409	-1.158	.451
1st Innings vs 2nd Innings	-1.718	248	.087	-.605	.352	-1.298	.089

Table no.4 shows that there is no significant difference in the mean total wide balls are bowled between Tournament and Series games in first inning. While there is a significant difference in the mean total wide balls are bowled between Tournament and Series matches in second inning. The results indicates that there is significant difference between series and tournament games in second inning which suggests that bowlers are more conscious in tournament games.

Table no.5 shows that the cross-tabulation types of bowler against types of wide deliveries in cricket. Across all types of bowling techniques, the majority of the deliveries are to the leg side (63.53% of total deliveries). This is most pronounced in fast medium (36.57%) and leg break (5.21%) out of spin bowlers. Fast medium bowling is the most probable to deliver a wide ball, accounting for 60.7% of all deliveries. Within this category, legside deliveries are also dominant (36.57%). Bouncers are the least common type of wide delivery, making up only 6.27% of total deliveries. They are most frequently used by fast bowlers (27 out of 130).

Table no.5: Crosstabulation of Bowler type and wide type

		Wide Type			
		legside	off side	bouncer	Total
Bowler Type	Fast	223 (10.76%)	90 (4.34%)	27 (1.3%)	340 (16.4%)
	fast medium	758 (36.57%)	409 (19.7%)	92 (4.44%)	1259 (60.73%)
	leg break	108 (5.21%)	59 (2.85%)	4 (0.19%)	171 (8.25%)
	off break	102 (4.92%)	28 (1.35%)	3 (0.14%)	133 (6.42%)
	orthodox	97 (4.68%)	32 (1.54%)	3 (0.14%)	132 (6.37%)
	wrist spin	29 (1.40%)	8 (0.39%)	1 (0.05%)	38 (1.83%)
Total		1317 (63.53%)	626 (30.2%)	130 (6.27%)	2073 (100%)

Pearson Chi-Square Value = 35.637, Sig = 0.000

This analysis suggests a general trend for leg side wide deliveries among all wide deliveries, with fast medium bowling being the predominant likely to deliver a wide. Further, significance test revealed that there is a significant association between bowler types and wide types.

Table no.6: Cross tabulation of Bowler Hand and Wide Type

		Wide Type			Total
		leg side	off side	bouncer	
Bowler Hand	Right	934 (45.06%)	485 (23.40%)	83 (4.00%)	1502 (72.46%)
	Left	383 (18.48%)	141 (6.80%)	47 (2.27%)	571 (27.54%)
Total		1317 (63.53%)	626 (30.20%)	130 (6.27%)	2073 (100%)

Pearson Chi-Square Value = 14.293, Sig = 0.001

Table no.6 shows that the cross tabulation bowler hand against wide type deliveries in cricket. For both right-handed and left-handed bowler, leg side deliveries are the most common. Right-handed bowler face a higher proportion of offside deliveries (23.40%) compared to left-handed bowler (6.80%). Bouncers are less common overall but slightly more prevalent for right-handed bowler (4.00%) compared to right-handed bowler (2.27%). In addition to this, significance test showed that there is a significant association between the bowler hand and wide type delivery.

Table no.7: Descriptive Statistics of Bowler's Height and Wide Type

	N	Mean	Std. Deviation	Std. Error	Minimum	Maximum
Leg side	1317	1.8316	.08693	.00240	1.00	2.10
off side	626	1.8368	.08627	.00345	1.63	2.10
Bouncer	130	1.8398	.08773	.00769	1.63	2.10
Total	2073	1.8337	.08678	.00191	1.00	2.10

Table no.7 shows the descriptives of the height of bowler and wide type. This table indicates that the sample sizes for each group vary, with leg side having the largest no. of wide delivery (1317) while bouncer have smallest (130).Also this table shows that the groups' average heights vary slightly from one another, according to the descriptive statistics, but overall, the groups' height variability is comparable.

Table no.8: ANOVA of height.

ANOVA for Bowlers Height					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.016	2	.008	1.090	.337
Within Groups	15.589	2070	.008		
Total	15.605	2072			

Table no.8 describe that the ANOVA table for bowler's height. The result shows that the differences in mean height of bowlers across the three groups (leg side, off side, and bouncer) are not statistically significant. The variation in height within each group is much larger than the variation between the groups.

Conclusion:

The primary objective of this study was to investigate the role of wide balls in T-20 cricket. This chapter outlines the methodology employed to meet the study's goals. A meticulously designed proforma was utilized to collect data, capturing every wide ball delivery and related factors influencing both the wide balls and match outcomes. The proforma was divided into three sections: overall match outcome factors, wide balls and associated factors in the first innings, and wide balls and associated factors in the second innings. Data was gathered from Cricinfo's official website, focusing on ball-by-ball information from T-20 matches played post-COVID-19 (2020-2021). The analysis covered various tournaments including the World Cup, Asia Cup, and series matches. Descriptive statistics were computed and illustrated using diagrams and graphs such as bar charts and pie charts. Statistical tests, including T-tests, Chi-square tests, and ANOVA, were applied to analyze the data. Team 1 had 82 occurrences of wide balls,

Team 2 had 95, and a third team had 73 occurrences, with teams playing abroad. Among the matches, 54 were tournament matches and 196 were series matches, with tournament matches representing 21.6% and series matches 78.4%. Toss-winning percentages favored Team 2 (56.80%) over Team 1 (43.20%), and decisions to field first (56.80%) were more common than to bat first (43.20%). Winning by runs (52.82%) was more prevalent than winning by wickets (47.18%). Fast bowlers delivered 15% of wides, primarily on the leg side, with fast-medium bowlers accounting for around 60% of wide deliveries, and spin bowlers contributing 25%. Left-handed bowlers delivered 26% of wides, with right-handed bowlers delivering 72% of wides. Descriptive statistics of wide deliveries showed that the mean number of wide deliveries was 4.78 in the first innings and 3.47 in the second innings for winning teams, compared to 3.94 and 4.27 for losing teams, respectively. Wide deliveries contributed approximately 13% to runs margin and 30% to balls remaining margin. The paired T-test revealed significant differences in wide balls between innings and various conditions, including toss winners, match winners, and home versus guest teams. Series matches exhibited a higher frequency of wide balls compared to tournaments, with bowlers showing more caution in tournament games. The analysis also found significant differences in wide deliveries between innings and match types, indicating that bowlers are more mindful during tournament games. Additionally, the cross-tabulation of bowler types and wide ball deliveries revealed a tendency for leg-side deliveries across all bowling styles, with fast-medium bowlers being most likely to deliver wide balls. There was also a significant association between bowler hand and wide delivery types, and ANOVA results indicated no significant difference in average bowler height across wide delivery types.

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