St Joseph's University

36, Lalbagh Road, Bengaluru-560027

Topic

Statistical Perspectives on Badminton Match Strategy

Presented by

Shreya Ramesh

222MCS28

Under the guidance of

Leonard Winston Aiman

Declaration

I Shreya Ramesh, 2nd year student of St. Joseph's University currently pursuing B.Sc. MT-CS (semester IV) of batch 2022-2025, declare that this research paper titled "Statistical Perspectives on Badminton Match Strategy" is my own work, conducted under the supervision of Leonard Winston Aiman. I affirm that the content of this paper, to the best of my knowledge contains no material previously published by any other person and has not been submitted for any other degree or qualification at any other university. Any sources used or referred to in this paper are duly acknowledged.

Certificate

This is to certify that the term paper "Statistical Perspectives on Badminton Match Strategy", submitted by Shreya Ramesh under the guidance of Leonard Winston Aiman, Assistant Professor, School of Physical sciences, Department of Mathematics, St. Joseph's University, for the success of the partial fulfilment of Bachelor Degree in Mathematics and Computer Science is a report of the candidate's effort.

Leonard Winston Aiman

Assistant Professor

School of Physical sciences, Department of Mathematics

St Joseph's University

Bengaluru

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I thank our Vice-Chancellor Rev. Dr. Victor Lobo SJ for providing me the opportunity to do the project work and I owe my deep gratitude to my project guide Mr. Leonard Winston Aiman, Assistant Professor, School of Physical Sciences, Department of Mathematics, St. Joseph's University, Bangalore.

I would also like to thank my parents and my brother for giving me the strength, knowledge, ability and opportunity to undertake this project."

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- No. of Consecutive Points earned by Winner and the Match Duration in minutes.

Do teams with left-handed players have advantage or exhibit success over teams with same or another handedness.

Statistical Perspectives on Badminton Match Strategy
By Shreya Ramesh

Abstract

The study's goal is to analyse match results of different badminton doubles divisions using descriptive and inferential statistics. The study primarily focuses on applying a variety of statistical techniques to give an understanding on how various factors in the context of badminton matches assist a player in selecting the best strategy in order to have a higher chance of winning. The study also looks at a team's handedness and offers conclusions and analysis on how a team's ability to win a match is not determined by the handedness of a pair, but rather by tactics, game strategy, and individual talents.

Introduction

Badminton is a racquet sport played using racquets and a shuttlecock which is hit across a net. A match is played to the best of 3 sets, and a set is won when a player reaches 21 points, with a difference of, at least, 2 points.

Each point that a player wins grants them the right to serve the following point, or consecutive points as they are known colloquially. The serve is made from the right zone to the other side of the court on even points and from the left zone to the other side on odd points.

In addition to men's and women's singles, which are played on a court with boundaries, there are three different kinds of doubles: men's doubles, women's doubles, and mixed doubles (which is a pair of men and women) is played on the entire court.

The application and result of tactical actions are critical to a player's ability to surpass their opponent in dyadic interactions, even though strength, speed, and endurance are vital as well.

Studies say that only about 10-13% of the population is left-handed, it has long been noted that in certain interactive sports like badminton there is often a surprisingly high proportion of left-handers playing at elite levels.

When it comes to a player's handedness, sport statistics show that left-handed players are more likely to have the advantage in interactive professional sports like badminton. This could be because their opponents, who are primarily right-handed, are less accustomed to their actions and will not have time to react.

Being less common than right-handers may have given left-handers a fitness edge in one-on-one combat, which may offset some of the disadvantages associated with being left-handed. This might also be the result of right-handed players not imitating their left-handed opponents' gameplay style.

It is also found that small teams such as badminton doubles are assumed to have a performance advantage if they are composed of one right- and one left-handed player.

Additionally, research indicates that left-handed athletes have a psychological edge as well as a tactical or strategic edge in a variety of competitive sports.

The current study aimed to identify tactical patterns that differentiated a pair's performance in badminton doubles against other teams in each category, including handedness, in order to gain a better understanding of the complexities of interacting performance factors in badminton match-play.

This was accomplished by comparing the teams competing in various game forms by looking at a variety of performance factors. Thus, differences among particular contexts of play against different opponents were analysed.

Methods

Participants and General Procedure

The study selected a total of 139 matches (set of games) around 300 games played under the BWF world championships 2023, across all forms of badminton doubles.

The BWF World Championships stand alongside the Olympics as the ultimate test for any badminton player. Since its beginnings in 1977, the event has evolved over 27 editions.

The tournament was based on a knockout basis and the winners of the tournament are:

Men's doubles	KANG Min Hyuk SEO Seung Jae	Left- Right pair
Women's doubles	CHEN Qing Chen JIA Yi Fan	Left- Right pair
Mixed doubles	SEO Seung Jae CHAE Yu Jung	Left-Left pair

3 game formats and handedness were considered and labelled as:

Men's doubles	Right-Right
Women's doubles	Right-Left
Mixed doubles	Left -Left

In each game format, the handedness of the winner and loser was recorded.

Materials

Data entry was done using official match statistics from the BWF world championship website.

First, the game formats were recorded. Next, each player from a pair had their handedness recorded, which was categorized under winner type handedness and loser type handedness based on the three labels mentioned above.

The match duration was also noted down in minutes which is the total time taken to complete a set of best of 3 matches of which some teams played 2 while others played 3 games. This was recorded under the field of number of games played in the match duration.
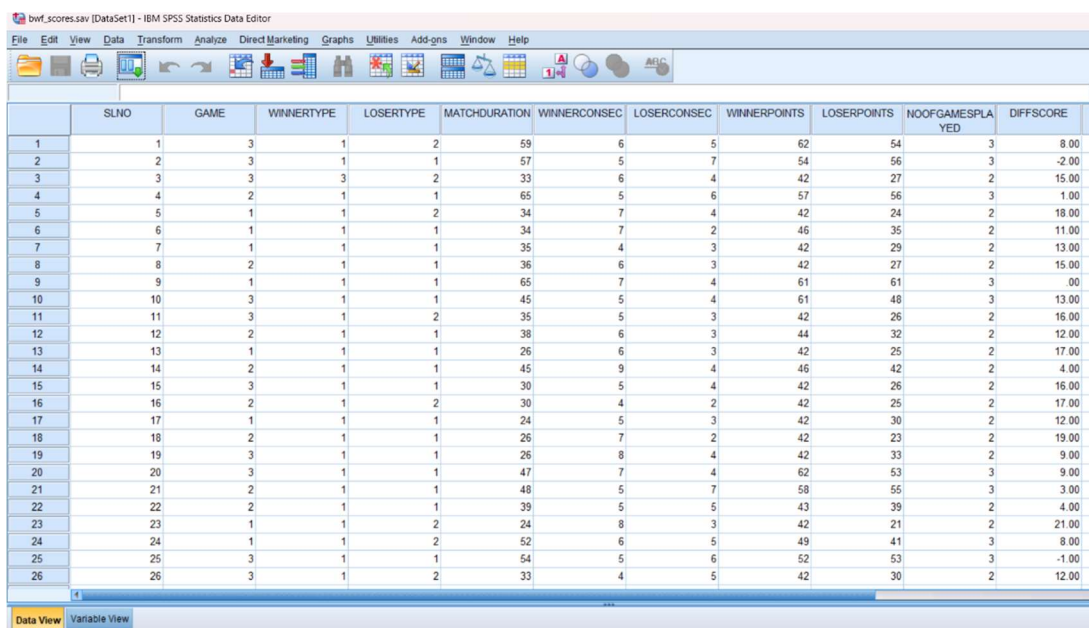
The official match statistics were used to record the number of consecutive points earned by the winner and loser which were recorded as no. of consecutive points by winner/loser, as well as the match's total score by the winning and losing team (best of three), in the appropriate areas.

The difference in score between the winner and loser was also calculated to better understand the performance of each team as the analysis of scores in mainly based on the point difference in a combination of 2 or 3 games in one match.

Statistical Analysis

The following software programs were used:

Microsoft Excel spreadsheet to store the results and also for visualization of data and IBM SPSS to perform statistical calculations using descriptive and inferential statistical tests and to calculate differences and correlations

bwf_scores.sav [DataSet1] - IBM SPSS Statistics Data Editor

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	SLNO	GAME	WINNERTYPE	LOSERTYPE	MATCHDURATION	WINNERCONSEC	LOSERCONSEC	WINNERPOINTS	LOSERPOINTS	NOOFGAMESPLAYED	DIFFSCORE
1	1	3	1	2	59	6	5	62	54	3	8.00
2	2	3	1	1	57	5	7	54	56	3	-2.00
3	3	3	3	2	33	6	4	42	27	2	15.00
4	4	2	1	1	65	5	6	57	56	3	1.00
5	5	1	1	2	34	7	4	42	24	2	18.00
6	6	1	1	1	34	7	2	46	35	2	11.00
7	7	1	1	1	35	4	3	42	29	2	13.00
8	8	2	1	1	36	6	3	42	27	2	15.00
9	9	1	1	1	65	7	4	61	61	3	.00
10	10	3	1	1	45	5	4	61	48	3	13.00
11	11	3	1	2	35	5	3	42	26	2	16.00
12	12	2	1	1	38	6	3	44	32	2	12.00
13	13	1	1	1	26	6	3	42	25	2	17.00
14	14	2	1	1	45	9	4	46	42	2	4.00
15	15	3	1	1	30	5	4	42	26	2	16.00
16	16	2	1	2	30	4	2	42	25	2	17.00
17	17	1	1	1	24	5	3	42	30	2	12.00
18	18	2	1	1	26	7	2	42	23	2	19.00
19	19	3	1	1	26	8	4	42	33	2	9.00
20	20	3	1	1	47	7	4	62	53	3	9.00
21	21	2	1	1	48	5	7	58	55	3	3.00
22	22	2	1	1	39	5	5	43	39	2	4.00
23	23	1	1	2	24	8	3	42	21	2	21.00
24	24	1	1	2	52	6	5	49	41	3	8.00
25	25	3	1	1	54	5	6	52	53	3	-1.00
26	26	3	1	2	33	4	5	42	30	2	12.00

Data View Variable View

Under correlations, both Pearson's as well as Spearman's correlation was considered in order to ensure accuracy.

Three variables need to be statistically tested to ensure that they are significant. The variables are difference in score, number of points scored by winner and number of consecutive points scored by loser.

Initially, normality was tested for the variables with the Shapiro-Wilk test of which the difference in score was found to be normally distributed with a significance value greater than 0.05

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Difference in score between winner and loser	.057	139	.200[*]	.984	139	.115

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Histogram

Mean = 12.40
Std. Dev. = 6.854
N = 139
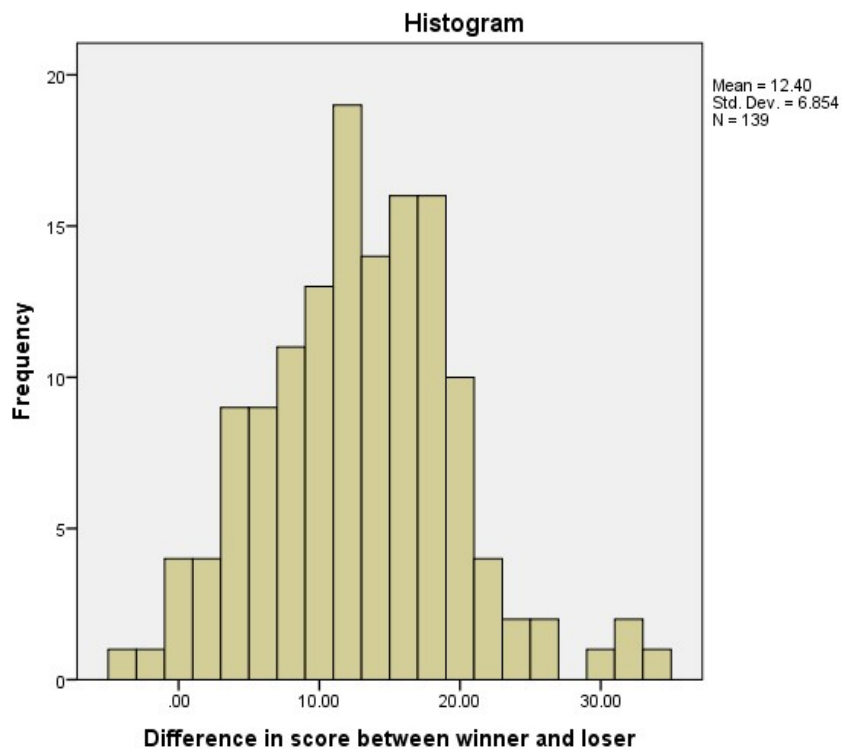
One sample T- test was conducted on variables No. of Consecutive Points earned by winners and losers respectively. The sig value or p-value of .000 indicates that the observed mean difference is statistically significant at conventional levels (typically p < .05).

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
No. of Consecutive Points earned by Winner	139	6.25	1.915	.162
No. of Consecutive Points earned by Loser	139	4.02	1.380	.117

Comparing the one sample statistics with the results of the one-sample t-tests, we see that the mean values are consistent with the mean differences reported earlier. Additionally, the standard deviations provide insight into the variability of consecutive points earned within each group.

A standard deviation around 1.915 and 1.380 suggests that there is moderate variability in the number of consecutive points earned by winners. Some players may earn significantly more or fewer consecutive points than the mean of 6.25 and 4.02, contributing to the spread of the data around the mean.

One-Sample Test

	Test Value = 0					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
No. of Consecutive Points earned by Winner	38.485	138	.000	6.252	5.93	6.57
No. of Consecutive Points earned by Loser	34.349	138	.000	4.022	3.79	4.25

Results

1. Relationship between No. of Consecutive Points earned by Winner/Loser and No. of games played in the match duration.

Correlations

		No. of Consecutive Points earned by Winner	No. of games played in the match duration
No. of Consecutive Points earned by Winner	Pearson Correlation	1	**-.217**[*]
	Sig. (2-tailed)		.010
	N	139	139
No. of games played in the match duration	Pearson Correlation	**-.217**[*]	1
	Sig. (2-tailed)	.010	
	N	139	139

*. Correlation is significant at the 0.05 level (2-tailed).

Correlations

			No. of Consecutive Points earned by Winner	No. of games played in the match duration
Spearman's rho	No. of Consecutive Points earned by Winner	Correlation Coefficient	1.000	-.212[*]
		Sig. (2-tailed)	.	.012
		N	139	139
	No. of games played in the match duration	Correlation Coefficient	-.212[*]	1.000
		Sig. (2-tailed)	.012	.
		N	139	139

*. Correlation is significant at the 0.05 level (2-tailed).

Pearson's product correlation of No. of Consecutive Points earned by Winner and No. of games played in the match duration was found to be **very low negative correlation** and 95% significant ($0.10 <= r <= 0.30$ and $p = 0.05$).

Correlations

		No. of Consecutive Points earned by Loser	No. of games played in the match duration
No. of Consecutive Points earned by Loser	Pearson Correlation	1	.482[**]
	Sig. (2-tailed)		.000
	N	139	139
No. of games played in the match duration	Pearson Correlation	.482[**]	1
	Sig. (2-tailed)	.000	
	N	139	139

[**]. Correlation is significant at the 0.01 level (2-tailed).

Correlations

			No. of Consecutive Points earned by Loser	No. of games played in the match duration
Spearman's rho	No. of Consecutive Points earned by Loser	Correlation Coefficient	1.000	.529[**]
		Sig. (2-tailed)	.	.000
		N	139	139
	No. of games played in the match duration	Correlation Coefficient	.529[**]	1.000
		Sig. (2-tailed)	.000	.
		N	139	139

[**]. Correlation is significant at the 0.01 level (2-tailed).

Pearson's product correlation of No. of Consecutive Points earned by Loser and No. of games played in the match duration was found to be **low positive correlation** and significant ($0.30 <= r <= 0.50$ and $p < 0.05$).

Here the number of games increases as the number of consecutive points of losers increases.

This shows that a winning team would have an advantage if they were to score more consecutive points, which would result in less games being played in a match i.e. a best-of-three set would probably end in two sets.

2. Relationship between the No. of Consecutive Points earned by Winner and Difference in score between winner and loser in badminton doubles match.

Correlations

		No. of Consecutive Points earned by Winner	Difference in score between winner and loser
No. of Consecutive Points earned by Winner	Pearson Correlation	1	.455**
	Sig. (2-tailed)		.000
	N	139	139
Difference in score between winner and loser	Pearson Correlation	.455**	1
	Sig. (2-tailed)	.000	
	N	139	139

**. Correlation is significant at the 0.01 level (2-tailed).

Correlations

			No. of Consecutive Points earned by Winner	Difference in score between winner and loser
Spearman's rho	No. of Consecutive Points earned by Winner	Correlation Coefficient	1.000	.409**
		Sig. (2-tailed)	.	.000
		N	139	139
	Difference in score between winner and loser	Correlation Coefficient	.409**	1.000
		Sig. (2-tailed)	.000	.
		N	139	139

**. Correlation is significant at the 0.01 level (2-tailed).

Pearson's product correlation of No. of Consecutive Points earned by Winner and Difference in score between loser and winner was found to be **low positive correlation** and significant ($0.30 <= r <= 0.50$ and $p<0.05$).

Correlations

			No. of Consecutive Points earned by Loser	Difference in score between winner and loser
No. of Consecutive Points earned by Loser	Pearson Correlation		1	-.605**
	Sig. (2-tailed)			.000
	N		139	139
Difference in score between winner and loser	Pearson Correlation		-.605**	1
	Sig. (2-tailed)		.000	
	N		139	139

**. Correlation is significant at the 0.01 level (2-tailed).

Correlations

			No. of Consecutive Points earned by Loser	Difference in score between winner and loser
Spearman's rho	No. of Consecutive Points earned by Loser	Correlation Coefficient	1.000	-.613[**]
		Sig. (2-tailed)	.	.000
		N	139	139
	Difference in score between winner and loser	Correlation Coefficient	-.613[**]	1.000
		Sig. (2-tailed)	.000	.
		N	139	139

**. Correlation is significant at the 0.01 level (2-tailed).

Pearson's product correlation of No. of Consecutive Points earned by Loser and Difference in score between loser and winner was found to be **moderate negative correlation** and significant ($0.50 <= r <= 0.70$ and $p<0.05$).

Which shows that as the number of consecutive points by a loser increases, there is clear decrease in the score difference between the winner and loser. Thus, an increase in no of consecutive points by a winning team would lead to a slight increase in the difference between the score played under 2 or 3 games.

This analysis proves as evidence to the previous finding which shows that the difference in the score is slightly higher when the team maintains a streak, given the fact that there are lesser number of games played in a match.

This also gives conclusive evidence that maintaining a consecutive streak in the rally would give an upper hand in being in lead throughout the match which will in turn be an influencing factor in the probability of a team to win.

3. Relationship between No. of Consecutive Points earned by Winner and the Match Duration in minutes.

Correlations

		No. of Consecutive Points earned by Winner	Match Duration in minutes
No. of Consecutive Points earned by Winner	Pearson Correlation	1	-.288**
	Sig. (2-tailed)		.001
	N	139	139
Match Duration in minutes	Pearson Correlation	-.288**	1
	Sig. (2-tailed)	.001	
	N	139	139

**. Correlation is significant at the 0.01 level (2-tailed).

Correlations

			No. of Consecutive Points earned by Winner	Match Duration in minutes
Spearman's rho	No. of Consecutive Points earned by Winner	Correlation Coefficient	1.000	-.332**
		Sig. (2-tailed)	.	.000
		N	139	139
	Match Duration in minutes	Correlation Coefficient	-.332**	1.000
		Sig. (2-tailed)	.000	.
		N	139	139

**. Correlation is significant at the 0.01 level (2-tailed).

Pearson's product correlation of No. of Consecutive Points earned by Winner and match duration was found to be **very low negative correlation** and significant (0.10 <= r <= 0.30and p<0.05).

Correlations

		No. of Consecutive Points earned by Loser	Match Duration in minutes
No. of Consecutive Points earned by Loser	Pearson Correlation	1	.527[**]
	Sig. (2-tailed)		.000
	N	139	139
Match Duration in minutes	Pearson Correlation	.527[**]	1
	Sig. (2-tailed)	.000	
	N	139	139

**. Correlation is significant at the 0.01 level (2-tailed).

Correlations

			No. of Consecutive Points earned by Loser	Match Duration in minutes
Spearman's rho	No. of Consecutive Points earned by Loser	Correlation Coefficient	1.000	.603[**]
		Sig. (2-tailed)	.	.000
		N	139	139
	Match Duration in minutes	Correlation Coefficient	.603[**]	1.000
		Sig. (2-tailed)	.000	.
		N	139	139

**. Correlation is significant at the 0.01 level (2-tailed).

Pearson's product correlation of No. of Consecutive Points earned by Loser and match duration was found to be **moderate positive correlation** and significant ($0.50 <= r <= 0.70$ and $p < 0.05$).

Hence the match duration increases when the loser scores more consecutive points.

From the table, we learn that as the number of consecutive points increase, the match duration decreases gradually which gives the winning team an advantage to maintain their momentum and win the match with lesser effort.

Results related to handedness of a team.

4. Do teams with left-handed players have advantage or exhibit success over teams with same or another handedness.

		Total	Loser Handedness	
		TOTAL.	Right-Right	Right-Left
Total		35	31	4
Winner Handedness	Right-Left	80%	84%	50%
	Left-Left	20%	16%	50%

Winner Handedness vs Loser Handedness among left handed winners
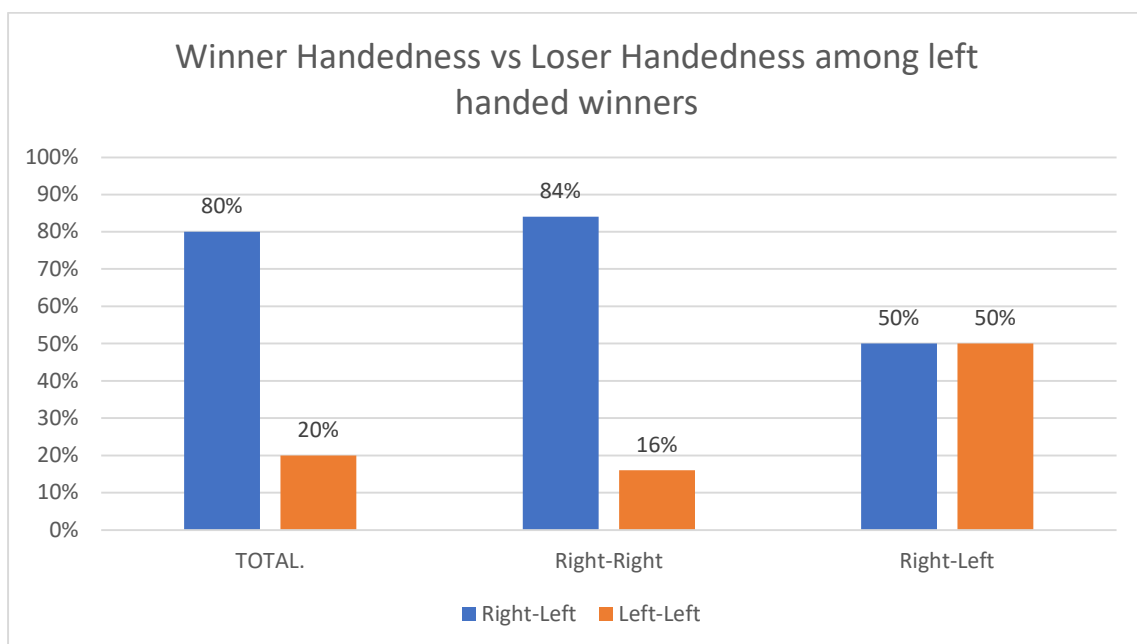
To determine the win percentage of teams with left-handed players, a subsample of 139 BWF world championship matches was taken.

The aforementioned data indicates that, in this specific sample, a left-handed and right-handed player combination has a higher chance of winning against a right-handed duo. In a similar vein, a team facing their own handedness usually has an equal chance of winning.

Performance of teams with left-handed players specific to mixed doubles

| | | Total | Loser Handedness | |
		TOTAL.	Right-Right	Right-Left
Total		15	12	3
Winner Handedness	Right-Left	53%	58%	33%
	Left-Left	47%	42%	67%

Winner Handedness vs Loser Handedness among left handed winners in mixed doubles
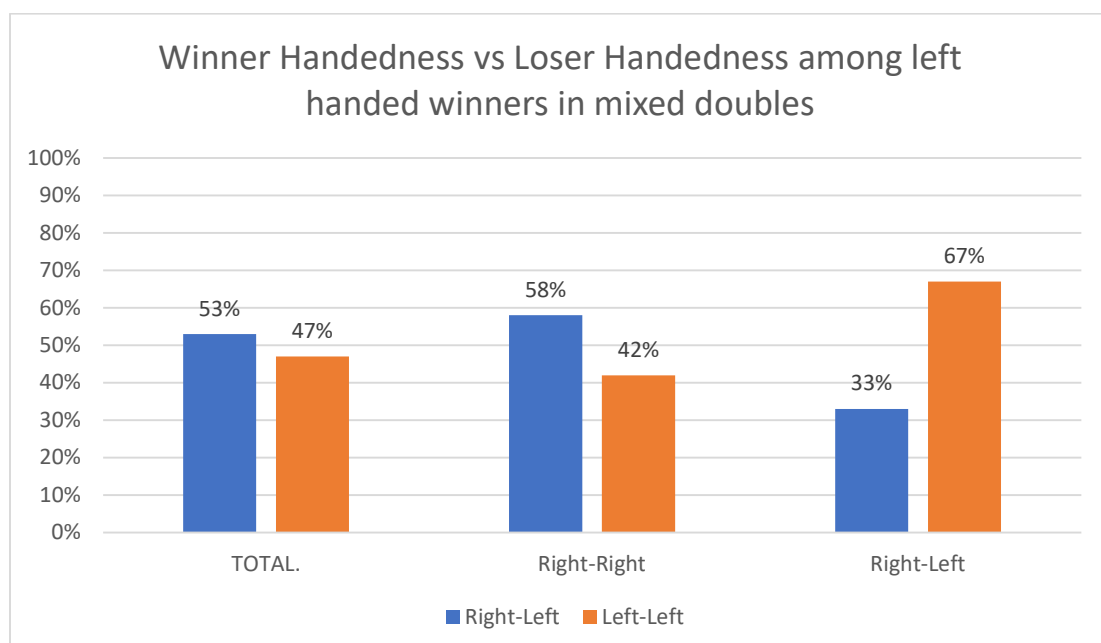
Here, from the table it can be studied that a right- and left-handed pair has a higher win percentage against and right pair but a left-handed pair is able to exhibit more win rate against a right and left pair.

Hence it can be concluded that even though a right and left-handed pair posed advantage in this sample, it cannot be concluded that the same team may exhibit an advantage under all situations/games.

Conclusion

The study yields significant insights and reveals that a winning team's ability to string together consecutive points correlates with a reduction in the number of games played within a match. This phenomenon not only indicates the team's dominance but also contributes to maintaining a strong momentum throughout the match. Moreover, matches tend to have a shorter duration, especially in the context of best-of-three-set games, where they are more likely to conclude within two sets if one team establishes a notable lead.

These findings underscore the advantage enjoyed by the winning team, as they are able to control the flow of the game and capitalize on their momentum. However, it's important to note that the advantage observed with right and left-handed pairs in the sample doesn't necessarily translate to a universal advantage across all situations or games. Contextual factors, such as the strategies employed by opposing teams or specific match conditions, can significantly influence the outcome and mitigate any inherent advantages. Therefore, while the study provides valuable insights, it also emphasizes the complexity of competitive dynamics in badminton and the need for nuanced analysis in evaluating team performance.

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