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# A Point Difference Analysis Established by Winners and Losers in International Badminton Doubles Matches

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**Abstract**

The aim of this study is to analyze the point difference established in three different phases between winners and losers in international men's and women's badminton doubles matches. Analyzing 183 matches from the 2021 TotalEnergies World Championship, each match was divided into three phases: Phase 1 (0-7 points), Phase 2 (8-14 points), and Phase 3 (15-21 points). Maximum Point Difference (MPD) and Maximum Consecutive Points (MCP) were examined to assess player performance. Kruskal-Wallis H and Mann-Whitney U statistical tests were conducted. Significant differences between winners and losers were found in all phases, with the difference increasing significantly over phases with medium to large effect sizes. The first seven points significantly increase a player's chances of winning. 72% (men's category) and 75% (women's category) of players won, who was ahead in the point difference in the first phase of the game. In the men's category, 67.4% won who were ahead in point difference in all three phases. Whereas in the women's category, it is 70.45%. Winners in both categories had significantly ($p<0.05$) higher consecutive points than the losers. In the second phase, the winners averaged 5 to 6 points over the losers in both categories. The winners kept increasing their point difference in every phase. On the other hand, in losers, the point difference decreased throughout the game. These findings underscore the importance of early lead acquisition and suggest potential strategies and tactics to enhance players' winning probabilities.

***Keywords:*** *badminton, match analysis, consecutive point, match results*

## Introduction

The sport of badminton stands out as one of the fastest games played globally, particularly in the doubles format, requiring an immense level of fitness, skill, and energy (Butterworth et al., 2012). In addition, it requires a quick series of high-intensity movements (Abian-Vicen et al., 2013). Badminton sport entails five disciplines: women's singles, men's singles, women's doubles, men's doubles, and mixed doubles. As a result of gender differences, each of these disciplines has its playing requirements (Gawin et al., 2015). Abian-Vicen et al. (2013) conducted a comprehensive investigation into the temporal and notational patterns of elite badminton matches involving both male and female players. Their study revealed notable gender differences among variables like shots per rally, rally time, rest time, & match duration, with male players displaying significantly larger values. The association between technical skills, stroke play, and player performance was analyzed in international badminton matches. There is a significant difference in the percentage of shots played and the type of shots used by female and male athletes (Lee et al., 2005; Zhang et al., 2013).

The Badminton World Federation (BWF) annually hosts a

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series of international tournaments covering all five aforementioned disciplines. Within these tournaments, several leagues or knockout games adopt a three-set format, each consisting of 21 points. This format shift occurred in 2006, transitioning from the previous three sets with 15 points each (Hsin-Lian et al., 2018). This change subsequently altered the physical, technical, and physiological aspects of the sport, highlighting the need for increased scientific investigation (Ming et al., 2008; Phomsoupha & Laffaye, 2015).

While the application of data analytics to assess performance in various sports is growing, research on the utilization of point differences to analyze badminton matches remains limited.

Studies in other sports such as soccer, tennis, and squash have explored the implications of point differences on match outcomes, competitiveness, and predictive models (Baert & Amez, 2018; Karlis & Ntzoufras, 2009). However, certain studies have concentrated on analyzing the impact of goal difference by examining the variations in match running performance pre & post scoring a goal (Buchheit et al., 2018). In racquet sports like Tennis and Squash, researchers examined point difference analysis between players to determine their competitiveness, performance level, and rating. In addition, a statistical model was proposed to assess the probability of winning based on the point difference (Ley et al., 2018; Marcus, 2001; Pfeiffer et al., 2010). Existing research on point difference in badminton is scarce; two of these studies have examined men's and women's singles matches, showing similar findings (Bagchi et al., 2022; Barreira et al., 2016). However, there remains a gap in understanding point difference in badminton, particularly within the context of doubles matches, calling for further investigation.

The current literature on the badminton doubles discipline covers: technical and tactical analysis, a comparison of doubles and singles badminton based on physiological demands, a comparison of men's and women's doubles matches based on timing factors and competition analysis between singles and doubles discipline (Abián-Vicén et al., 2018; Alcock & Cable, 2009; Gawin et al., 2015; Pérez-Turpin et al., 2020; Zhang et al., 2013).

The initial moments of a game hold significant importance in predicting its outcome. A player's likelihood of winning increases as they establish a lead in the match (Barreira et al., 2016). Consequently, studying the point difference becomes crucial for anticipating the game's conclusion. This analysis can aid coaches and players in formulating pregame strategies and in-game tactics. Thus, the primary aim of this study is to examine the point difference established in three different phases between winners and losers in international men's and women's badminton doubles matches.

## Methods

### *Participants*

Data from men's and women's doubles matches played during 2021 TotalEnergies BWF World Championships held in Spain from 12th to 19th December were collected to conduct this study. This data was publicly available after the Badminton World Federation (BWF) championship and was collected from tournament software (www.tournamentsoftware.com). This championship draw included three rounds, quarterfinals, semi-finals, and finals. A total of 183 games (men's – 95 and women's – 88) were analyzed from the 2021 TotalEnergies World Championship matches. In each game, we recorded maximum point differences (MPD) and maximum consecutive points (MCP) separately for winners and losers in each phase.

### *Data Collection*

Data from the 183 games were meticulously collected and organized in Microsoft Excel (Microsoft Corporation, Redmond, WA, USA) spreadsheets. Each game was divided into three phases to analyze the point difference: phase 1, phase 2, and phase 3. These phases, namely phase 1, phase 2, and phase 3, were defined based on point ranges: phase 1 encompassed point differences between 0 and 7, phase 2 consist of 8 to 14 points and Phase 3 is of 15 to 21 or above points. Based on a study conducted by Barreira et al. (2016), a point difference is a maximal difference between the scores of the winner and loser established in each phase of the game. It is calculated by subtracting the maximum score attained from the minimum score conceded by a player during the phase. In cases where neither the winner nor the loser attained a lead during a particular phase, a value of zero was attributed. To gain a clearer insight into the maximum point difference at every stage of the game, we constructed a sample line graph (as illustrated in Figure 1).

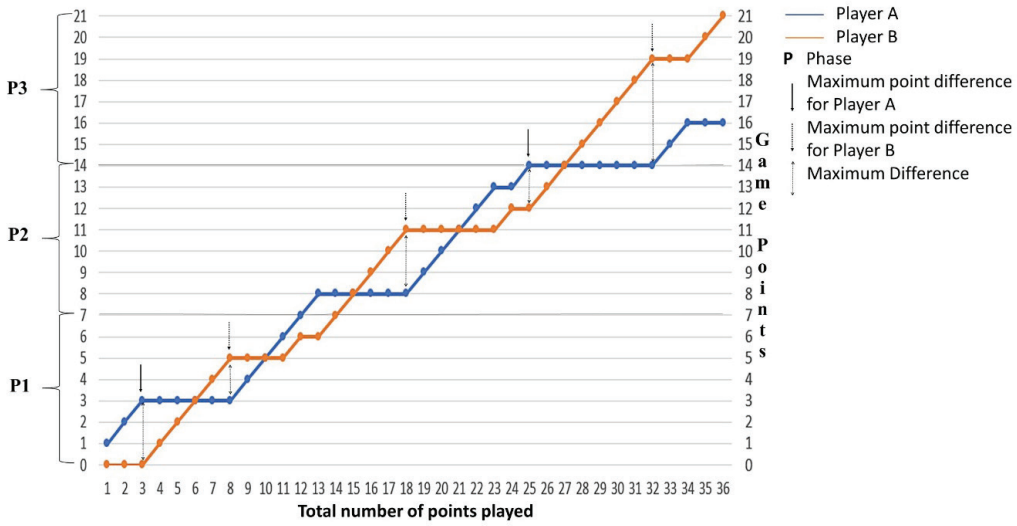


FIGURE 1. Illustrates the maximum point difference established in each phase between winners and losers of the match

*Statistical Analysis*

The data collected were described using descriptive statistics such as average, median, standard deviation, quartiles, minimums, and maximums. The distribution of the data was supported by using Skewness, Kurtosis and their standard error values were calculated. The maximum point difference (MPD) and maximum consecutive points (MCP) between winners and losers were compared in each phase using the Mann-Whitney U test. Utilizing the Kruskal-Wallis H test, we conducted a comparative analysis of the point differences between winners and losers across the three stages. Effect size measurements were employed to determine the magnitude of the observed point differences. Statistical analyses were performed using SPSS software (version 24, IBM, New York, USA), maintaining a significance level of 0.05 for all tests.

## Results

The findings of this study suggest that in both men's and women's matches, winners (Men's Category - MC: 5.03±3.13, Women's Category - WC: 5.77±3.44) are ahead of losers (MC: 0.72±1.34, WC: 0.63±1.20) throughout all the phases of the game. In both categories, winners exhibit a lower level of variation around the mean in point difference and demonstrate a higher frequency of scoring consecutive points compared to losers (refer to Table 1).

**Table 1.** Descriptive Statistics for Phase-wise Maximum Point Difference and Maximum Consecutive Points (MCP) of Winners and Losers in Men's and Women's Categories

| | Gender | Match Outcome | Mean | Md | SD | CV | Skewness | Std. Error of Skewness | Kurtosis | Std. Error of Kurtosis |
|---|---|---|---|---|---|---|---|---|---|---|
| Overall | Men | Win | 5.03 | 5 | 3.1 | 0.6 | 0.79 | 0.14 | 0.6 | 0.29 |
| | | Loss | 0.72 | 0 | 1.3 | 1.8 | 3.18 | 0.14 | 15.61 | 0.29 |
| | Women | Win | 5.77 | 5 | 3.4 | 0.6 | 0.7 | 0.15 | 0.16 | 0.3 |
| | | Loss | 0.63 | 0 | 1.2 | 1.9 | 2.07 | 0.15 | 3.87 | 0.3 |
| Phase - 1 | Men | Win | 2.91 | 3 | 1.5 | 0.5 | 0.05 | 0.25 | -0.37 | 0.49 |
| | | Loss | 1.12 | 1 | 1.2 | 1 | 0.87 | 0.25 | -0.13 | 0.49 |
| | Women | Win | 3.28 | 3 | 1.7 | 0.5 | 0.17 | 0.26 | -0.27 | 0.51 |
| | | Loss | 1.11 | 1 | 1.3 | 1.2 | 1.15 | 0.26 | 0.73 | 0.51 |
| Phase - 2 | Men | Win | 5.15 | 5 | 2.7 | 0.5 | 0.01 | 0.25 | 0.16 | 0.49 |
| | | Loss | 0.65 | 0 | 1.5 | 2.3 | 3.46 | 0.25 | 16.1 | 0.49 |
| | Women | Win | 5.78 | 5 | 2.8 | 0.5 | 0.06 | 0.26 | -0.5 | 0.51 |
| | | Loss | 0.49 | 0 | 1.3 | 2.6 | 2.79 | 0.26 | 7.42 | 0.51 |
| Phase - 3 | Men | Win | 7.03 | 7 | 3.4 | 0.5 | 0.45 | 0.25 | -0.3 | 0.49 |
| | | Loss | 0.38 | 0 | 1.3 | 3.3 | 5.55 | 0.25 | 38.4 | 0.49 |
| | Women | Win | 8.25 | 8 | 3.5 | 0.4 | 0.28 | 0.26 | -0.4 | 0.51 |
| | | Loss | 0.3 | 0 | 0.8 | 2.8 | 2.94 | 0.26 | 7.89 | 0.51 |
| MCP | Men | Win | 4.73 | 4 | 1.8 | 0.4 | 0.79 | 0.25 | 0.92 | 0.49 |
| | | Loss | 3.16 | 3 | 1.4 | 0.4 | 1.04 | 0.25 | 5.42 | 0.49 |
| | Women | Win | 5.83 | 6 | 1.9 | 0.3 | 0.83 | 0.26 | 0.7 | 0.51 |
| | | Loss | 3.27 | 3 | 1.3 | 0.4 | 1.52 | 0.26 | 3.96 | 0.51 |

Note: MCP - Maximum Consecutive Points; Mean – Arithmetic mean; Md - Median; SD – Standard Deviation; CV - The Coefficient of Variation

Table 2 shows that 72% (MC) and 75% (WC) of players won the match who were ahead in point difference during the first phase of the game. Similarly, 86% (MC) and 89% (WC) of players who were not ahead in point difference anytime during the first phase lost the game. The analysis of the players who lost the game shows that 76% (MC) and 83% (WC) of the athletes were not ahead on the scoreboard at any time during the second phase, and this frequency got increased to 84% (MC) and 86% (WC) in the final phase of the game.

For players who lost the game, 35% (MC) and 40% (WC) were not ahead during any phase of the game, and 20% (MC) and 18% (WC) opened the highest point difference than the opponent in the first phase of the game. Our analysis revealed that players needed to maintain a lead of more than one point in the second and third phases to secure victory. Specifically, in men's doubles matches, the average point difference between winners and losers increased from five points in the second phase to seven points in the third phase. Similarly, in women's doubles, this metric increased to eight points in the third phase from six in phase two.

The analysis revealed significant trends in match outcomes based on point differences across various phases of the game. During the first phase, a considerable percentage of players won the match when leading in point difference: 72% in the men's category (MC) and 75% in the women's category (WC). Conversely, a substantial proportion of players who trailed in point difference during this phase ended up losing the match: 86% in MC and 89% in WC.

Further analysis of players who ultimately lost the game unveiled notable patterns. In the second phase, the majority of players who were defeated did not hold a lead on the scoreboard at any point: 76% in MC and 83% in WC. This trend

intensified in the final phase, with 84% in MC and 86% in WC failing to take the lead at any time.

For those players who ultimately lost, a significant proportion failed to secure a lead throughout any phase of the game: 35% in MC and 40% in WC. Additionally, a noteworthy finding was that 20% (MC) and 18% (WC) of losing players achieved the highest point difference compared to their opponents during the first phase.

Further analysis revealed that a lead of more than one point in the second and third phases significantly increased the likelihood of winning the game. Specifically, in men's doubles, winners maintained an average lead of five points over their opponents in the second phase, which expanded to seven points in the third phase. Similarly, in women's doubles, the average lead increased from six points in the second phase to eight points in the third phase. These findings highlight the critical role of point differences in determining match outcomes and suggest strategies for achieving success in doubles matches.

**Table 2.** Analysis of Match Outcomes Based on Point Differences in Different Phases of the Game

| Metric | MC | WC |
|---|---|---|
| Players won when ahead in point difference during first phase | 72% | 75% |
| Players lost when not ahead in point difference during first phase | 86% | 89% |
| Players lost when not ahead at any time during the second phase | 76% | 83% |
| Players lost when not ahead at any time during the final phase | 84% | 86% |
| Players lost and were not ahead during any phase of the game | 35% | 40% |
| Losing players who had the highest point difference in the first phase | 20% | 18% |
| Average point difference between winners and losers (second phase) | 5 points | 6 points |
| Average point difference between winners and losers (third phase) | 7 points | 8 points |

For further analysis, Kruskal Wallis H and Mann Whitney U tests were used as the data failed to satisfy the assumptions of normal distribution. The Kruskal-Wallis H test was employed to assess the phase-wise MPD, while the comparison of MCP difference between Winners and Losers was conducted using the Mann Whitney U test.

As shown in Figure 2, in all three phases, the maximum point differences are significantly ($p<0.05$) higher in winners than losers.

In Table 3, the effect size was computed for each of the

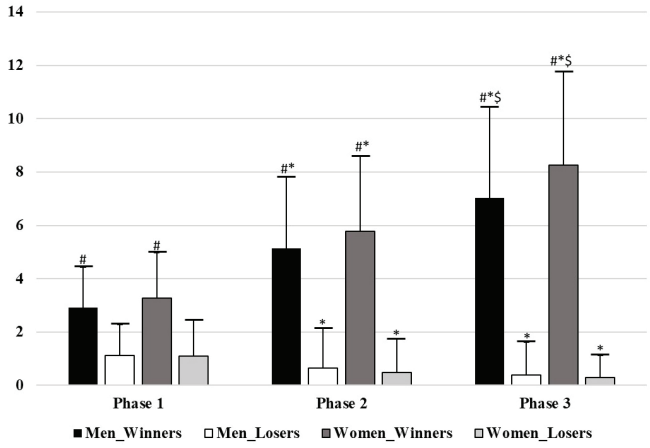


FIGURE 2. Illustrates the mean and standard deviation (SD) of the maximum point difference between the winners and losers of men's and women's doubles matches across each phase of the games throughout the entire championship. Notably, # denotes a significant difference in each phase compared to the loser, * represents a significant difference compared to phase one, and $ represents a significant difference compared to phase two

phases. In all three phases, the magnitude of the difference was significantly large for both categories (MC: 0.56, 0.76, 0.87 and WC: 0.6, 0.81, 0.9). Therefore, it has shown a very high point difference between winners and losers with a large magnitude and kept on increasing throughout the phase.

While comparing the point differences for winners and losers in each phase separately, there were significant ($p<0.05$) differences in all the phases of winners and losers for both categories. In both categories, the point difference in winners kept increasing from Phase 1 to Phase 3. Whereas in losers, this difference got reduced. Post hoc test, followed by the effect size for each significant difference, was calculated.

In both categories, while comparing the overall point difference between all three phases of winners and losers separately, both showed a large (Winners - MC: 0.3 and WC: 0.35, Losers - MC: 0.15 and WC: 0.14) effect size. In the case of winners, it showed a significant difference ($p<0.05$) across all the comparisons, with a large effect size in phases 1 & 2 (MC : 0.68 and WC: 0.67), a moderate effect size in phases 2 & 3 (MC: 0.37 and WC: 0.48), and again a large effect size in phase 1 & 3 (MC: 0.88 and WC: 0.97). Whereas losers in both the categories showed a significant difference in phases 1 & 2 and phases 1 & 3 with moderate (MC: 0.45 and WC: 0.49) and large (MC: 0.63 and WC: 0.59) effect sizes, respectively. In the case of phases 2 & 3, losers of both categories failed to show significant ($p>0.05$) differences in point differences.

**Table 3.** Statistical Comparison across different phases in Men's Doubles and Women's Doubles

| | | Men Doubles | | Women Doubles | |
|---|---|---|---|---|---|
| | | **Mean±SD** | **p-value [r] Magnitude** | **Mean±SD** | **p-value [r] Magnitude** |
| Phase 1 | Winners | 2.91±1.52 | 0.000 [0.56]L | 3.28±1.69 | 0.000 [0.6]L |
| | Losers | 1.12±1.16 | | 1.11±1.33 | |
| Phase 2 | Winners | 5.15±2.67 | 0.000 [0.76]L | 5.78±2.84 | 0.000 [0.81]L |
| | Losers | 0.65±1.5 | | 0.49±1.25 | |
| Phase 3 | Winners | 7.03±3.39 | 0.000 [0.87]L | 8.25±3.53 | 0.000 [0.9]L |
| | Losers | 0.38±1.25 | | 0.3±0.83 | |
| MCP | Winners | 4.7±1.8 | 0.000 [0.48]M | 5.8±1.9 | 0.000 [0.67]L |
| | Losers | 3.2±1.4 | | 3.3±1.3 | |
| Winners (Overall) | Phase 1 | 2.91±1.52 | 0.000 [0.3]L# | 3.28±1.69 | 0.000 [0.35]L# |
| | Phase 2 | 5.15±2.67 | | 5.78±2.84 | |
| | Phase 3 | 7.03±3.39 | | 8.25±3.53 | |
| Losers (Overall) | Phase 1 | 1.12±1.16 | 0.000 [0.15]L# | 1.11±1.33 | 0.000 [0.14]L# |
| | Phase 2 | 0.65±1.5 | | 0.49±1.25 | |
| | Phase 3 | 0.38±1.25 | | 0.3±0.83 | |
| Winners (post hoc) | Phase 1 | 2.91±1.52 | 0.000 [0.68]L | 3.28±1.69 | 0.000 [0.67]L |
| | Phase 2 | 5.15±2.67 | | 5.78±2.84 | |
| | Phase 2 | 5.15±2.67 | 0.000 [0.37]M | 5.78±2.84 | 0.000 [0.48]M |
| | Phase 3 | 7.03±3.39 | | 8.25±3.53 | |
| | Phase 1 | 2.91±1.52 | 0.000 [0.88]L | 3.28±1.69 | 0.000 [0.97]L |
| | Phase 3 | 7.03±3.39 | | 8.25±3.53 | |
| Losers (post hoc) | Phase 1 | 1.12±1.16 | 0.000 [0.45]M | 1.11±1.33 | 0.000 [0.49]M |
| | Phase 2 | 0.65±1.5 | | 0.49±1.25 | |
| | Phase 2 | 0.65±1.5 | 0.118 [0.16]S | 0.49±1.25 | 0.469 [0.08]T |
| | Phase 3 | 0.38±1.25 | | 0.3±0.83 | |
| | Phase 1 | 1.12±1.16 | 0.000 [0.63]L | 1.11±1.33 | 0.000 [0.59]L |
| | Phase 3 | 0.38±1.25 | | 0.3±0.83 | |

Note: r – Correlation Coefficient (Z/√n) Effect Size; # – Eta Squared (η2); T – Trivial Effect Size; S – Small Effect Size; M – Moderate Effect Size; L – Large Effect Size

Figure 3 shows a significant difference in maximum consecutive points between winners and losers with an effect size ($r = Z/\sqrt{n}$) of 0.48 in the men's category and 0.67 in the women's category. Therefore, the match is more likely to be won by the winners because they have more consecutive points.

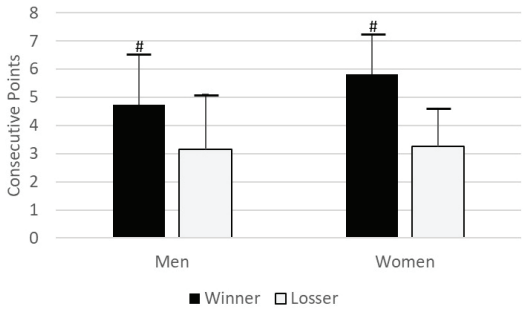


FIGURE 3. Mean and SD of maximum consecutive points between winner and loser during all the games in the entire championship. Note- # represents a significant difference (<0.05) in each phase in relation to the loser.

## Discussion

The research findings have demonstrated that winners in both categories (Men and Women Doubles) consistently exhibited notably wider point differences than losers throughout various phases of the game. The players need to score consecutive points and keep their opponents' point differences from increasing to win the game. Winners of both categories showed the highest point difference in the game's final phase. In com-

parison, losers showed up in the first phase. However, the winners of men's doubles were, on average, five points ahead of their opponents in phase two, which increased to seven in the third phase. Similarly, in women's doubles, this metric increased to eight points in the third phase from six in phase two.

In badminton, irrespective of the format, the outcome of the match can be predicted based on the performance in the initial phase of the game. Taking the lead during the first phase significantly enhances the likelihood of winning the game. The game's later stages demanded more endurance, strategic decisions, and high concentration to sustain the performance (Gómez et al., 2021). Hence, it reduces the chances of losing if the players try to take the lead at least once in the first phase of the game. It has been established in several studies that the first stage of a match is crucial to the outcome of the game (Duarte et al., 2012; García-Rubio et al., 2015). It is essential to understand the scoring performance dynamics to develop better match strategies (Gómez et al., 2021).

Bagchi et al. (2022) and Barreira et al. (2016) have studied the point difference analysis between the winners and losers among male and female badminton players, respectively; it has been determined that the style of playing badminton and the selection of shots differ quite a bit between men and women. Real-time played, percentage of time played, shots per rally, rally time, strokes per point, and work-to-rest ratio were significantly higher, and the number of shorts played per second was lower in the women's doubles category compared to men's doubles. Hence, in women's doubles, the matches were longer with greater real-time, while men's doubles were more intense (Abián-Vicén et al., 2018; Gawin et al., 2015; Torres-Luque et al., 2019). One study disclosed that in badminton, as the number of unforced errors per rally increases, there is a greater likelihood of losing a match. The chances of winning a game increase when you make more winning shots than your opponent (Cabello Manrique & González-Badillo, 2003). Alder and Broadbent (2017) after extensive research in anticipatory behaviour in badminton during competition, found that women's doubles exhibit a higher percentage of anticipatory behaviors compared to men's doubles. Conversely, men's doubles display a notably longer average response time compared to women's doubles.

It has been reported that expert badminton athletes grasp game situations more readily than novices (Blomqvist et al., 2000). The findings imply that success in a badminton match depends on knowing the opponent's strategy and quick analysis, which should be done primarily in the opening stages of the game. 86% of players in men's doubles lost the game who could not get ahead in the scorecard anytime during the first phase, and this metric rose to 89% in the women's doubles category. Therefore, to enhance the likelihood of winning the game, it's crucial to lead on the scoreboard during the initial phase. In men's doubles, 20% of losing teams have established the largest point difference over their opponents in the first phase of the game. Similarly, in women's, this metric got decreased to 18%. It is not about only opening highest in phase one but also trying to maintain it in later stages. Chances are, a player won't win the game if they're not leading on the scoreboard during the first phase.

Research on similar lines can be done for other sports as more literature is needed to analyze the sports using point difference analysis. Based on such data, a mathematical prediction model can be developed for predicting the outcome of a match. Based on the study's analysis, winning chances can be enhanced, and the result can be predicted. Coaches and players can use it to analyze the opponent before a game to devise strategies for victory. Additionally, this will help coaches and players adjust tactics during matches based on point differences.

*Limitations and Future Directions*

The research offers valuable insights into the dynamics of point differences in international-level badminton tournaments, specifically in men's and women's doubles matches. This focus helps us understand how point differences influence match outcomes in these competitive formats. However, the study's findings cannot be extrapolated to other levels of badminton tournaments. Additionally, the study did not include mixed doubles matches, leaving that part of the competitive format unexplored. The study uses data from matches played in 2021, giving us a snapshot of that year but not a full picture of long-term trends. Analyzing data of several years (eg. Last 5 years) could provide a more comprehensive view and make the study's conclusions even stronger. Future studies can focus on the aforementioned limitations.

## Conclusions

This study aimed to analyze the point difference established at different phases of the game by the men's and women's doubles players in international badminton matches. The game was divided into three phases (P1 – 0 to 7 points, P2 – 8 to 14 points and P3 – 15 to 21 points). The results depicted that the winners in both categories consistently held higher point differences than losers across all phases underscores the importance of gaining and maintaining leads throughout the match. Furthermore, the notable increase in point differences as matches progress highlights the momentum-building aspect of maintaining an advantage. We also found that winners of men's and women's doubles were, on average, 5 to 6 points ahead of their opponents in phase two and 7 to 8 points ahead in phase 3. The significance of this study lies in its contribution to understanding the dynamics of point differentials in men's and women's doubles badminton matches at the international level. By dissecting the game into distinct phases and analyzing the point differences established by players, the research sheds light on critical patterns and trends crucial for strategizing and improving performance. Overall, this study enriches the understanding of competitive dynamics in badminton doubles matches, offering valuable implications for training, tactics, and performance enhancement in the sport.

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**Conflict of interest:**
The authors declare that there are no conflict of interest:

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