

Sex differences in the temporal dynamics of professional Beach Tennis matches

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Abstract:

Problem Statement: Beach Tennis (BT) has experienced rapid international growth in recent years, increasing the need for scientific evidence to support training and performance optimization. However, knowledge regarding the temporal characteristics of professional BT matches remains limited. Although recent research has begun to characterize the temporal demands of professional women's Beach Tennis, comparative evidence involving men's and women's competitions remains limited. **Approach:** Thirty-two professional matches (16 men's and 16 women's) from eight ITF Beach Tennis World Tour Sand Series tournaments were analyzed, comprising 3,453 points (1,724 men's and 1,729 women's). Temporal variables included total match time (TMT), actual match time (AMT), rally duration (Rally), interval between points (Interval), rally duration distribution, and work-to-rest ratio. Differences between sexes were analyzed using independent-samples *t* tests, with Cohen's *d* used to estimate effect size. **Purpose:** To compare the temporal structure of professional men's and women's Beach Tennis matches and provide updated evidence on the temporal demands of elite competition. **Results:** Women's matches presented significantly longer rallies than men's matches (5.26 ± 0.64 vs. 4.25 ± 0.69 s; $p < 0.001$; $d = 1.52$). No significant sex differences were observed for TMT (76.4 ± 19.0 vs. 74.1 ± 17.9 min), AMT (7.95 ± 2.31 vs. 9.24 ± 1.69 min), or interval duration (29.7 ± 5.26 vs. 26.7 ± 4.38 s). Short- and medium-duration rallies predominated in both categories, with 77.5% of men's rallies and 68.3% of women's rallies lasting ≤ 6 s. The overall work-to-rest ratio was approximately 1:6, supporting the intermittent nature of elite BT competition. **Conclusions:** This study provides a comprehensive comparison of the temporal structure of professional men's and women's Beach Tennis matches under the current ITF rules. Although the overall temporal profile was similar between sexes, women's matches were characterized by significantly longer rallies. These findings improve understanding of the temporal demands of elite BT and provide evidence to support sport-specific, evidence-based training strategies for coaches and practitioners.

Key Words: performance analysis; rally duration; racquet sports; work-to-rest ratio.

Introduction

Beach Tennis (BT) originated in Ravenna, Italy, in 1987 and has since evolved into a globally recognized racket sport. Combining elements of tennis, beach volleyball, and badminton, BT presents unique technical, tactical, and physiological demands while sharing structural and functional characteristics with other racket sports (Silva et al., 2017; Cádiz Gallardo et al., 2023).

BT matches are played on a divided court, with alternating player participation, and the primary objective is to return the ball to the opponent's field without it touching the sand. Matches follow a best-of-three sets format, with each set composed of six games, and each game following a traditional tennis scoring system (15, 30, 40, game). Like other racket sports, BT exhibits an acyclic nature, characterized by repeated short-duration, high-intensity actions interspersed with brief recovery periods (Cádiz Gallardo et al., 2023). Time-motion analysis has been widely applied in racket sports to characterize performance demands and their physiological implications (Cádiz Gallardo et al., 2023). Given the increasing global participation in BT, research has explored various aspects, including injury prevalence (Berardi et al., 2020; Rodrigues et al., 2024), physiological responses to exercise intensity (Jung et al., 2024; Lauria et al., 2025), physical performance assessments (Machado et al., 2024), scoring patterns (Lauria et al., 2023), and time-related match dynamics (Pérez Turpin et al., 2013; Sanchez-Alcaraz Martínez & Gómez-Mármol, 2013). Temporal structure analysis is widely used to characterize the physiological and tactical demands of sport by examining variables such as effort duration, work-to-rest ratio, and intensity fluctuations (Manrique & Padial, 2002). Observational methodologies have provided insights into temporal structures across multiple sports, such as beach volleyball (Costa et al., 2020), tennis (Prieto-Lage et al., 2022), padel (Martín-Miguel et al., 2023), and badminton (Fontes et al., 2014).

In doubles sports, and with professional athletes, rally durations typically remain below 10 s, averaging 6.9 ± 4.0 s in beach volleyball (with a work-to-rest ratio of approximately 1:4) (Natali et al., 2019), and 3.45 ± 2.91 s in doubles tennis, with a work-to-rest ratio of 1:6 (Martínez-Gallego et al., 2021). In Beach Tennis, previous studies (Pérez Turpin et al., 2013; Sanchez-Alcaraz Martínez & Gómez-Mármol, 2013) have investigated real-time actions versus total match duration, as well as rally times in competitive settings. Rally durations predominantly fall within short-duration categories, with 47% lasting under 3 s, 28% between 3 and 6 s, and 25% exceeding 6 s (Sanchez-Alcaraz Martínez & Gómez-Mármol, 2013). More recently, Lima et al. (2025), in a study of elite men's doubles, reported an average total match duration of 76 min 41.71 s $\pm$ 12 min 30.05 s, with only 6 min 32.55 s $\pm$ 1 min 12.26 s (8.6%) spent in active play. The average rally lasted 3.65 ± 0.5 s, with a work-to-rest ratio ranging from 1:8 to 1:12.

Despite these findings, existing studies on the temporal structure of BT have notable limitations. Previous research has analyzed only a limited number of matches (four) (Pérez-Turpin et al., 2013), partial matches (only the first set) (Sanchez-Alcaraz Martínez & Gómez-Mármol, 2013), or a relatively limited number of points (approximately 700) (Lima et al., 2025). Moreover, most available evidence predates recent rule changes introduced by the International Tennis Federation (ITF). Specifically, the net height in the Men's PRO category was increased from 1.70 m to 1.80 m in 2023, and the restricted service zone for the server's partner was extended to six meters in 2024 (ITF, 2024). These modifications may have influenced playing dynamics by affecting rally speed, intensity, and duration, reinforcing the need for updated analyses under the current regulations. Understanding the temporal characteristics of match play is therefore important for characterizing the competitive demands of BT and informing sport-specific training strategies.

Recent evidence has also begun to characterize the temporal demands of professional women's Beach Tennis. Llantén et al. (2026) analyzed nine professional women's doubles matches from the 2024 Sand Series Tour Finals and reported an average rally duration of 6.8 ± 0.8 s, recovery intervals of 23.3 ± 2.0 s, and a work-to-rest ratio of 1:4.6. Although this study provides important evidence regarding the temporal characteristics of women's professional BT, it was restricted to a single tournament and did not directly compare men's and women's competitions. Consequently, comparative evidence regarding sex-related differences in the temporal organization of professional BT remains limited. Differences between men's and women's competition have been reported in other racket sports. A systematic review and meta-analysis of tennis demonstrated sex-related differences in physical demands and performance characteristics across competitive contexts, including differences in stroke and movement demands (Pluim et al., 2023). In addition, studies in padel and volleyball have reported differences in rally characteristics and temporal patterns between men's and women's competition (Lupo et al., 2018; Hileño et al., 2023). Based on this evidence, it is plausible that sex-related differences may also occur in the temporal organization of professional BT. In particular, women's matches may exhibit longer rally durations than men's matches, although the mechanisms underlying such differences remain unclear.

From an ecological dynamics perspective, athletic performance emerges from the continuous interaction between individual, environmental, and task constraints (Araújo & Davids, 2016). From this perspective, differences in athletes' physical and technical capacities may interact with common task constraints to generate distinct patterns of behavior during competition. In BT, such interactions may be reflected in variables such as rally duration, game pace, and the temporal organization of matches. Therefore, examining sex-related differences in temporal structure may provide insights into how individual constraints interact with the competitive environment. From a physiological perspective, further investigation of the temporal characteristics of BT is essential to improve understanding of the sport and support evidence-based training strategies. Current evidence suggests that the phosphagen and glycolytic energy systems, together with muscle power, contribute substantially to performance during high-intensity actions in BT (Lima et al., 2025). Therefore, characterizing the duration of rallies and recovery intervals may provide useful information for designing training protocols that reproduce the temporal demands of competition.

Therefore, this study aimed to compare the temporal structure of professional men's and women's Beach Tennis matches under the current ITF rules. We hypothesized that women's matches would exhibit longer rally durations than men's matches, whereas total match time, actual match time, and interval duration would show similar patterns between sexes.

Material & methods

Design

This study is characterized as an observational, cross-sectional, and analytical investigation, based on the notational analysis of matches, an approach widely used in sports performance analysis because it allows for the systematic collection of data in a real game context, without manipulation of independent variables (O'Donoghue, 2010; Hughes & Bartlett, 2002). The design aimed to describe and compare the temporal structure of professional Beach Tennis matches between men's and women's PRO categories under real competitive conditions. Matches were analyzed in an ecological context, without any intervention or manipulation of variables, ensuring that the data reflected the natural dynamics of competition. The observational approach followed a systematic and structured protocol for recording temporal variables, allowing

the quantification of match duration, rally duration, rest intervals, and work-to-rest ratios. This protocol functioned as an observation tool, with clearly defined criteria for each temporal variable, ensuring consistency in data recording. This design enables the identification of performance-related patterns and sex-related differences in the temporal demands of the sport (O'Donoghue, 2010).

Sample

A total of 32 BT matches were observed and analyzed, with an equal distribution across sex categories: 16 matches in the men's category and 16 in the women's category. These matches were selected across different competitive phases of the ITF Beach Tennis World Tour Sand Series tournaments, ensuring a more comprehensive temporal analysis. Specifically, four matches from each round (Round of 16, Quarterfinals, Semifinals, and Finals) were included for both men and women. The matches analyzed were selected based on broadcast availability.

The eight ITF Beach Tennis World Tour Sand Series tournaments observed were part of the ITF circuit and took place in 2024. These tournaments, known for their high competitiveness, awarded points for the international BT ranking and featured prize pools ranging from \$50,000 to \$100,000. Events were hosted in Brazil (four tournaments), France (one tournament), Germany (one tournament), Spain (one tournament), and Aruba (one tournament). Given that these tournaments attract the most elite BT athletes worldwide, the study provides an in-depth perspective on the temporal dynamics of high-performance BT matches.

A total of 56 athletes participated in the matches, 30 men (29±7 years) and 26 women (27±6 years). All athletes participating in the analyzed matches were internationally classified in the professional (PRO) category, as they ranked among the top 300 players worldwide and regularly competed in international-level tournaments (McKay et al., 2022). Information regarding the athletes' ages and rankings was obtained from the official website of the International Tennis Federation (www.itftennis.com/en/rankings/beach-tennis-tour-rankings/). The study encompassed a total of 3,453 points played, with 1,724 points in men's matches and 1,729 in women's matches. The match analysis was conducted using official tournament broadcasts available on the YouTube channel Play BT (www.youtube.com/@ProgramaPLAYBT). Ethical Committee approval and informed consent were not required for this study, as the analyzed videos are publicly available and freely accessible online without restrictions. Nonetheless, the privacy of the athletes was safeguarded by ensuring that no direct references to their identities were made in the text. The list of analyzed matches, including their respective tournaments, competitive phases, and the total number of points evaluated in each match, is presented in Table 1.

Table 1. Analyzed matches and their respective tournaments and places in the men's and women's categories.

Competitive phase	Men's	Points	Women's	Points
Finals	Reunion Classic (France)	108	Reunion Classic (France)	95
	Gran Canaria Classic (Spain)	109	Gran Canaria Classic (Spain)	133
	Ribeirão Preto (Brazil)	121	Ribeirão Preto (Brazil)	114
	Brasília (Brazil)	138	Brasília (Brazil)	140
Semifinals	São Paulo (Brazil)	138	São Paulo (Brazil)	112
	Saarlouis Classic (Germany)	88	Saarlouis Classic (Germany)	103
	Reunion Classic (France)	115	Reunion Classic (France)	97
	Brasília (Brazil)	124	Aruba (Aruba)	97
Quarterfinals	Gran Canaria Classic (Spain)	74	São Paulo (Brazil)	94
	Aruba (Aruba)	106	Saarlouis Classic (Germany)	109
	Brasília (Brazil)	84	Ribeirão Preto (Brazil)	76
	Saarlouis Classic (Germany)	113	Brasília (Brazil)	123
Round of 16	Ribeirão Preto (Brazil)	126	Saarlouis Classic (Germany)	87
	São Paulo (Brazil)	111	São Paulo (Brazil)	141
	Saarlouis Classic (Germany)	73	Aruba (Aruba)	93
	Aruba (Aruba)	96	Reunion Classic (France)	115
Total points		1,724	Total points	1,729

Procedure

Match analysis was conducted using high-resolution (1080p60 HD) recordings available on the Play BT YouTube channel. The recordings were reviewed with time precision measured in hours, minutes, and seconds. A digital stopwatch (SportWatch©), with millisecond-level precision, was used for precise timing of each rally and interval. The start of a point was defined as the moment the server made contact with the ball, while the end was determined by either the ball touching the ground or exiting the visible frame. This methodology allowed precise calculations of match duration, rally duration, and recovery intervals.

Points resulting from foot fault violations (when the server's foot touches the baseline during the service motion) were excluded from the analysis regarding rally time. However, these points were included in the calculation of total match duration. Points that could not be measured in full due to limitations in video transmission were considered up to the time allowed by the transmission. If the ball left the field of view, timing

was interrupted at the last visible frame, and the recorded duration up to that moment was retained for analysis. Based on the criteria, twenty-six points (0.75%) were therefore excluded from rally-duration analyses. Given the small proportion of excluded points, their influence on the overall estimates was likely limited. To ensure consistency, all measurements were performed by a single experienced researcher, minimizing interobserver variability. To assess intra-rater reliability, 100 randomly selected rallies were reanalyzed by the same observer. Agreement between measurements was assessed using the Intraclass Correlation Coefficient (ICC), demonstrating excellent reliability (ICC = 0.999).

The measured temporal variables included: a) Total Match Time (TMT): The duration from the first point's commencement to the conclusion of the last point of the match, recorded in minutes (min); b) Actual Match Time (AMT): The cumulative duration of all rallies in a match, recorded in minutes (min); c) Rally Duration (Rally): The duration of each rally, recorded in seconds (s), measured from the server's ball contact to the end of play. Rally duration was categorized into three-time intervals: short duration rallies (<3 s), medium duration rallies (3-6 s), long duration rallies (>6 s), based on a previous study (Sanchez-Alcaraz Martínez & Gómez-Mármol, 2013). Rally segmentation can be relevant additional information and allows an understanding of the predominance of points in a given phase of the rally, which can help coaches and athletes in technical and tactical decisions during a match. d) Interval between Points (Interval): Representing the average rest duration between points (s). Based on the information regarding the interval between points and the Rally average, the Work-Rest Ratio was calculated.

Data analysis

Data was compiled in Microsoft Excel before being imported into Jamovi software (version 2.3.28) for statistical analysis. The normality assumption of the data was confirmed using the Kolmogorov-Smirnov test. Descriptive statistics, including mean and standard deviation, were calculated for all variables. To evaluate differences between men's and women's categories, an independent samples t-test and the effect size (Cohen's d) was conducted for TMT, AMT, Rally, and Interval variables. Additionally, rally duration was categorized into three-time intervals: Short-duration rallies (<3 s), Medium-duration rallies (3-6 s), Long-duration rallies (>6 s). The proportion of rallies falling into each category was presented as percentage values. A significance level of $p < .05$ was set for all statistical analyses.

Results

Comparative Analysis Between Men and Women: The average values for the analyzed variables across sex categories (Figure I) were TMT: 76.4 ± 19.0 min (Men) vs. 74.1 ± 17.9 min (Women); AMT: 7.95 ± 2.31 min (Men) vs. 9.24 ± 1.69 min (Women); Rally: 4.25 ± 0.69 s (Men) vs. 5.26 ± 0.64 s (Women); Interval: 29.7 ± 5.26 s (Men) vs. 26.7 ± 4.38 s (Women). A significant difference in rally duration was observed between men and women ($p < .001$), with a very large effect size ($d = 1.52$), indicating that women's rallies were significantly longer than men's rallies. However, no significant differences were observed for TMT ($p = .726$), AMT ($p = .080$), or Interval ($p = .088$) between categories.

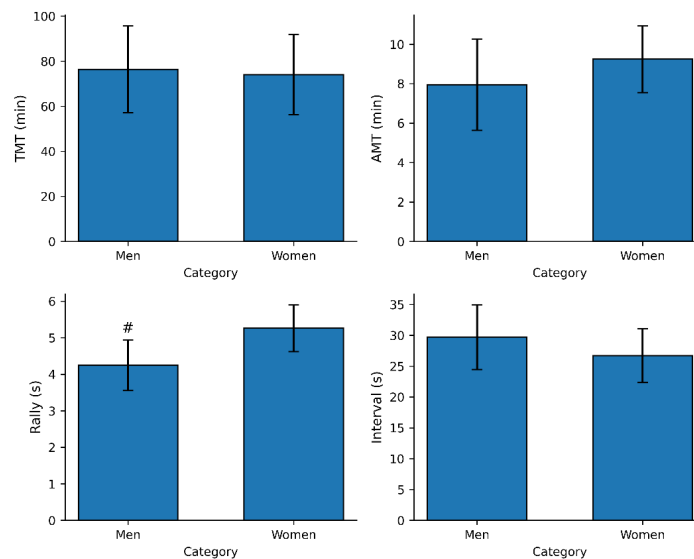


Figure I. Comparison of total match time (TMT), actual match time (AMT), rally duration (Rally), and interval between points between men's and women's professional Beach Tennis matches. Data are presented as mean $\pm$ SD.

Significant difference between sexes ($p < 0.001$).

Work-Rest Ratio: The relationship between rally duration and recovery time was analyzed, with a ratio of 1:7 in men's matches, while in women's matches it was 1:5. These data indicate an average work-rest ratio of approximately 1:6, indicating that for every 4 to 5 seconds of play (rally), the athletes dedicated approximately 30 seconds to recovery.

Rally Duration Distribution: Descriptive data showed a predominance of short-duration rallies (<3 s) in men's matches and medium-duration rallies (3-6 s) in women's matches. Short and medium-duration rallies dominated both men's and women's categories, while long-duration rallies (>6 s) were less frequent. Table 2 presents the distribution of rally durations in percentage values. The data indicate that 77.5% of rallies in men's matches lasted ≤6 seconds and 68.3% of rallies in women's matches lasted ≤6 seconds.

Table 2. Analysis of the predominance of points based on Rally duration.

	Total points	< 3 s (%)	3-6 s (%)	> 6 s (%)
Men	1724	742 (43.0%)	594 (34.5%)	388 (22.5%)
Women	1729	565 (32.7%)	616 (35.6%)	548 (31.7%)

Note: % = percentage values.

Discussion

The most important finding of the present study was the significantly longer rally duration observed in women's professional Beach Tennis matches compared with men's matches. This difference was associated with a very large effect size ($d = 1.52$), suggesting that sex-related characteristics substantially influence the temporal organization of elite BT competition.

One plausible explanation for the longer rallies observed in women's matches is that differences in stroke velocity may influence the temporal organization of play. Although ball velocity was not measured in the present study, systematic evidence from tennis indicates that men and women exhibit distinct physical and physiological demands during competition, reflecting consistent sex-related differences in physical demands and performance characteristics during elite tennis competition (Pluim et al., 2023). Consequently, it is reasonable to hypothesize that, if women exhibit lower average ball velocities during serves and attacking strokes, this could provide opponents with more time to anticipate, reposition, and successfully return the ball, thereby increasing the likelihood of prolonged rallies. This interpretation is consistent with notational analyses in professional padel, which have reported longer rallies and a lower frequency of immediate point-ending offensive actions in women's competition compared with men's (Lupo et al., 2018; Martín-Miguel et al., 2023). Similar sex-related differences in rally duration have also been described in badminton (Gomez et al., 2020; Winata et al., 2025) and volleyball (Hileno et al., 2023; Costa et al., 2021). Nevertheless, because ball velocity and stroke characteristics were not directly assessed in the present investigation, this explanation should be considered a plausible hypothesis that warrants confirmation in future studies. From an ecological dynamics perspective, the present findings may reflect different interactions between individual constraints (e.g., physical capacities), task constraints, and the competitive environment, ultimately generating distinct temporal patterns of match play between men and women (Araújo & Davids, 2016).

A recent study of professional women's doubles Beach Tennis analyzed nine matches from the 2024 Sand Series Tour Finals and reported an average rally duration of 6.8 ± 0.8 s and a recovery interval of 23.3 ± 2.0 s, resulting in a work-to-rest ratio of 1:4.6 (Llanten et al., 2026). The longer rally duration observed in that study compared with the present findings may reflect differences in tournament context, competitive phase, match characteristics, or analytical procedures. Nevertheless, both studies provide evidence that women's professional Beach Tennis is characterized by relatively prolonged rallies, supporting the present finding of longer rallies compared with men's competition.

Beyond the observed sex-related differences in rally duration, the remaining temporal variables exhibited similar patterns between men and women. The TMT observed in the present study was similar to that reported by Lima et al. (2025), at approximately 76 min in men's matches. These recorded values were higher than those reported in previous research (Pérez Turpin et al., 2013; Sanchez-Alcaraz Martínez & Gómez-Mármol, 2013). It's worth noting that previous studies don't analyze full matches. Even so, these variations in total match length can be attributed to the heterogeneity of the competitions analyzed, especially since previous studies were conducted before the rule changes implemented in BT. Interestingly, the AMT values recorded in this study were higher than those reported in a recent study (7.95 min vs. 6.33 min) using data from men's matches (Lima et al., 2025). Furthermore, factors such as tournament level (national vs. international), match format (best of two vs. best of three sets), competitive phase (preliminary vs. knockout rounds), and the skill level of the athletes (amateurs vs. professionals) may influence match duration. It is worth noting that the data from women's matches did not differ statistically from those from men's matches, tending to follow the same temporal pattern for TMT and AMT. The limited literature on the temporal characteristics of professional women's Beach Tennis restricts direct comparisons with previous studies.

The temporal analysis of beach tennis confirms that it is an intermittent sport characterized by alternating periods of effort and recovery. Beach Tennis relies on the integrated contribution of both aerobic and anaerobic energy systems. However, there appears to be a predominance of aerobic contribution when

considering the total match duration, which includes frequent intervals and breaks that substantially extend overall playing time. In contrast, when focusing on the actual rally durations and effective playing time, the anaerobic system emerges as critically important. From an energy system perspective, beach tennis relies heavily on the alactic anaerobic pathway in both men's and women's matches. The present findings demonstrate that 77.5% of the points in men's matches and 68.3% in women's matches lasted less than six seconds. Given the sport's demand for maximal effort during these short bursts of activity, the primary energy source is likely the intramuscular ATP-phosphocreatine (ATP-CP) system (McArdle et al., 2015; Liu et al., 2024). This aligns with prior research (Lima et al., 2025) indicating that high-intensity, short-duration efforts (typically under 10 seconds) depend on this energy pathway. However, the data also reveal that a proportion of rallies exceed 6 seconds (22% in men and 31.7% in women), suggesting that the lactic anaerobic system may play a role in energy supply during prolonged exchanges, particularly in women's matches.

The recovery period between points was found to follow a work-to-rest ratio of approximately 1:6, meaning that for every 4–5 seconds of effort, there were around 30 seconds of recovery. Previous research on BT (Lima et al., 2025) reported work-to-rest ratios ranging from 1:8 to 1:12, possibly due to regulatory changes affecting the restricted service zone, which came into effect in 2024. Notably, this study examined matches under the new regulations, offering updated insights into the current physiological demands of the sport. When comparing BT to other racket sports such as padel and tennis, it is evident that the recovery period between points is similar (Cádiz Gallardo et al., 2023), as players in these sports have a maximum rest interval of 25 seconds. However, in addition to physiological parameters such as workload, rally time, rest intervals, game density, and time between strokes, BT athletes' performance is also influenced by cognitive and psychological demands. Factors such as decision-making under pressure, pre-competitive anxiety, self-confidence, and attentional focus warrant further investigation in future studies.

Some limitations should be considered when interpreting these findings. Firstly, environmental factors such as temperature and humidity were not recorded, which may have influenced athlete performance and match dynamics. Additionally, variations in sand hardness across different tournaments were not accounted for, which could impact movement efficiency and rally duration. The use of publicly available YouTube broadcasts facilitated the analysis of a larger number of matches but may have reduced temporal measurement precision compared with direct access to original video files analyzed using specialized software. Match analysis via YouTube may present discrepancies compared to more precise software. Although frame-by-frame software may provide greater temporal precision, the use of official high-definition broadcasts enabled the inclusion of a larger and more representative sample of elite matches, thereby increasing the ecological validity of the findings. Despite technological advancements, the observation methodology remains an important tool for quick and cost-effective performance analysis across racket sports (Krizkova et al., 2021). Future studies should investigate amateur athletes, incorporate technical and tactical variables, quantify stroke velocity, and examine the psychological and cognitive demands associated with competitive BT. In addition, match selection was dependent on broadcast availability, which may have introduced a selection bias and limited the representativeness of the sample.

Practical Applications

The findings of this study provide specific and actionable insights for coaches and practitioners working in professional Beach Tennis (BT). The predominance of short-duration rallies, combined with relatively long recovery intervals, reinforces the intermittent nature of the sport and highlights the importance of training protocols focused on repeated high-intensity efforts interspersed with adequate recovery periods. The work-to-rest ratios observed in both categories offer practical guidance for structuring training sessions that replicate competitive demands, allowing for more ecologically valid training designs. For instance, interval-based drills can be organized to reflect the temporal structure identified in matches, enhancing the transfer of training to competition.

Additionally, the differences identified between men's and women's matches suggest that training strategies should consider sex-specific demands. The significantly longer rallies observed in women's matches suggest that conditioning programs may need to account for longer repeated high-intensity efforts when replicating the temporal demands of women's competition. From a broader perspective, these findings can be interpreted within non-linear approaches grounded in ecological dynamics, in which performance emerges from the interaction between task constraints and player behavior. In this context, training environments that simulate real match conditions and preserve functional variability may enhance adaptability and decision-making in athletes (Tan et al., 2025).

Furthermore, the integration of technological tools for performance analysis may support the monitoring and optimization of training processes, particularly in relation to temporal and tactical indicators, as demonstrated in similar racket sports such as tennis (Nurfadhila et al., 2026). Overall, the present results contribute to the development of more specific training and testing protocols aligned with the temporal and physiological demands of professional BT.

Conclusions

The present study provides the comprehensive comparison of the temporal structure of professional men's and women's Beach Tennis matches under the current ITF rules. The principal finding was that women's matches exhibited significantly longer rally durations than men's matches, whereas total match time, actual match time, and interval duration were similar between sexes. These findings suggest that the main difference in temporal structure between men's and women's matches was related to rally duration rather than total match time, actual match time, or interval duration. Furthermore, the temporal profile of Beach Tennis suggests an integrated contribution of aerobic metabolism to sustain match duration, while repeated short-duration, high-intensity actions rely predominantly on anaerobic energy pathways. From a practical perspective, these findings provide valuable information for coaches and practitioners by supporting the development of sport-specific training programs that replicate the temporal demands of competition and consider the distinct rally characteristics observed in men's and women's professional Beach Tennis.

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