



# Sex-based differences after 12-weeks of recreational beach tennis training on blood pressure in middle-aged adults with hypertension

## Diferenças entre os sexos após 12 semanas de treinamento recreacional de beach tennis na pressão arterial em adultos de meia-idade com hipertensão

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### ABSTRACT

**Introduction:** Recreational sport is an interesting exercise strategy for controlling blood pressure (BP), but sex-specific responses remain unclear. **Objective:** To explore potential differences in blood pressure and physical fitness between men and women with treated hypertension after a 12-week recreational beach tennis program. **Methods:** Forty-two participants (21 men) aged 35–65 years with a previous diagnosis of hypertension were randomized (2:1 ratio) into 12 weeks of beach tennis training group (two sessions per week lasting 45–60 min) or a no-exercise control group. Office BP, cardiorespiratory fitness, and muscle strength were analyzed at baseline and after the intervention period. Generalized estimating equations analyses were employed to examine the main effects of the intervention between the sexes. **Results:** In the beach tennis group, men demonstrated improvements in systolic and diastolic BP ( $-10 \pm 2$  and  $-7 \pm 2$  mmHg, respectively;  $p < 0.001$ ), handgrip test, and the 30s and five-time Chair-stand test after training. Women exhibited a significant improvement in systolic BP ( $-7 \pm 4$  mmHg,  $p = 0.031$ ) and 30s Chair-stand test. No significant changes in BP and physical fitness were found in the control group. In the comparison between groups, both men and women of the beach tennis group showed greater reductions in systolic BP compared with men and women in the control group ( $\Delta -18 \pm 6$  mmHg;  $p = 0.014$  and  $-16 \pm 5$  mmHg;  $p = 0.017$ , respectively). No significant differences between men and women in the beach tennis group were found for any variable. **Conclusion:** A 12-week recreational beach tennis training promotes similar improvements in BP and physical fitness in men and women with hypertension.

**Keywords:** Cardiovascular risk; Racquet sports; Exercise therapy; Cardiorespiratory fitness; Physical fitness.

### RESUMO

**Introdução:** Esportes recreacionais são uma estratégia interessante de exercício para o controle da pressão arterial (PA), mas as respostas específicas entre os sexos ainda não estão claras. **Objetivo:** Explorar possíveis diferenças na pressão arterial e na aptidão física entre homens e mulheres com hipertensão tratada após 12 semanas de um programa recreacional de beach tennis. **Métodos:** Quarenta e dois participantes (21 homens), com idade entre 35 e 65 anos e diagnóstico prévio de hipertensão, foram randomizados (proporção 2:1) para 12 semanas de treinamento de beach tennis (duas sessões semanais de 45–60 min) ou para um grupo controle sem exercícios. A PA de consultório, a aptidão cardiorrespiratória e a força muscular foram avaliadas no início e após o período de intervenção. Modelos de equações de estimativas generalizadas foram utilizados para avaliar os efeitos principais da intervenção entre os sexos. **Resultados:** No grupo de beach tennis, os homens apresentaram reduções na PA sistólica e diastólica ( $-10 \pm 2$  e  $-7 \pm 2$  mmHg, respectivamente;  $p < 0.001$ ), além de melhorias no teste de prensão manual e nos testes de sentar-levantar de 30 segundos e de cinco repetições. As mulheres apresentaram melhora significativa na PA sistólica ( $-7 \pm 4$  mmHg,  $p = 0,031$ ) e no teste de sentar-levantar de 30 segundos. Nenhuma alteração significativa na PA ou na aptidão física foi observada no grupo controle. Na comparação entre grupos, tanto homens quanto mulheres do grupo de beach tennis apresentaram maiores reduções na PA sistólica em comparação as mulheres do grupo controle ( $\Delta -18 \pm 6$  mmHg;  $p = 0,014$  e  $-16 \pm 5$  mmHg;  $p = 0,017$ , respectivamente). Não foram encontradas diferenças significativas entre homens e mulheres do grupo de beach tennis para nenhuma variável. **Conclusão:** Doze semanas de beach tennis recreacional promovem melhorias similares na PA e na aptidão física em homens e mulheres com hipertensão.

**Palavras-chave:** Risco cardiovascular; Esportes com raquete; Terapia com exercícios; Aptidão cardiorrespiratória; Aptidão física.

## Introduction

Sex-based differences in the prevalence and management of hypertension have received increasing attention in recent years<sup>1</sup>. While men exhibit a higher prevalence of hypertension than women until middle age (59% vs. 50%)<sup>2</sup>, women show a sharp increase in prevalence after menopause, reaching similar blood pressure (BP) values from the age of 60 onwards (74% vs. 75%, respectively)<sup>2</sup>. Furthermore, treatment and control rates remain unsatisfactory for both sexes, with slightly higher treatment rates in men (47% vs. 36% in women) but still low levels of adequate BP control (18% in men and 13% in women)<sup>3</sup>, requiring personalized strategies for hypertension management.

Regular physical activity contributes positively to BP control, with BP reductions after exercise programs comparable to those achieved with antihypertensive medications<sup>4</sup>. To be effective, exercise training programs must be carried out continuously and regularly, but fewer than one-quarter of adults meet the minimum physical activity recommendations to achieve BP benefits<sup>5</sup>. Participation in physical activities tends to differ between sexes<sup>6</sup>, with studies indicating that women often report lower adherence rates due to varied and complex barriers, such as less enjoyment and reduced confidence in their sports abilities compared to men of the same age group<sup>7</sup>. Therefore, exploring physical activity strategies that promote high adherence is relevant, especially for women.

Recreational sports have the potential to retain participants for longer periods when compared to traditional exercise interventions<sup>8</sup>. Beach tennis emerges as an interesting and accessible option for men and women at various ages and physical/technical abilities, requiring only 4 players per game. This sport is safe and feasible for patients with arterial hypertension<sup>9,10</sup>, presenting a lower risk of injuries compared to traditional invasive sports<sup>11,12</sup> and a high rate of enjoyment among its practitioners<sup>9,10</sup>. Other intermittent sports, such as soccer and rugby, are able to improve multiple physical capacities, including cardiovascular endurance, strength, and coordination, and also report marked decreases in BP after only 12-16 weeks of training<sup>13</sup>. Scarce data comparing the BP adaptations in men and women after exercise are controversial. A recreational soccer intervention seems to reduce BP in men and women with prediabetes<sup>14</sup>. However, post-exercise hypotension, a physiological phenomenon associated with chronic BP adaptations after training<sup>15</sup>, seems to

be more pronounced in men than women ( $\Delta$ -17 vs. -10 mmHg)<sup>16</sup>. Thus, further studies are warranted to clarify sex-specific adaptations to different exercise modalities, particularly in emerging sports such as beach tennis.

Therefore, the primary objective of this exploratory study was to compare the effect of 12-weeks of beach tennis training on the BP of men and women with hypertension. As a secondary objective, we compared sex-based differences in physical fitness parameters.

## Methods

### Study design

This study is a post-hoc analysis of the Beach Tennis and Hypertension Study (BAH Study), a superiority, randomized parallel-group clinical trial with an unequal allocation ratio (2:1)<sup>10</sup> and was conducted in order to compare the sex-based differences after a 12-week of beach tennis training in men and women with hypertension.

### Participants

The original sample size was estimated based on the original hypothesis, considering an initial sample size of 42 individuals with hypertension. They were randomized in a 2 : 1 ratio (Beach Tennis, n = 28; Non-exercising control, n = 14) to be able to detect a difference of  $4 \pm 6$  mmHg in systolic BP between groups<sup>10</sup>. The detailed inclusion criteria are described in the original study<sup>10</sup>. In summary, men and women aged 35-65 years with a diagnosis of hypertension, taking up to three anti-hypertensive medications, and not engaged in structured exercise programs in the past 3 months were eligible. Exclusion criteria were: cardiovascular disease diagnosed in the last 24 months, as well as other chronic diseases, and diabetic proliferative retinopathy. The recruitment was through social media, personal references, and phone calls. All participants provided written informed consent before participation. Randomization procedures have been described elsewhere<sup>10</sup>. The beach tennis instructors were blinded to the randomization list until assignment. The study protocol was conducted according to the principles of the Declaration of Helsinki and in compliance with the Brazilian legal and regulatory framework for research involving human beings (resolution number 466/12). The study protocol was approved by the Institutional Review Board of Porto Alegre Clinical Hospital, Brazil (GPPG-FIPE registry: 2018-0642). This study was reported in accordance with the Consolidated Stan-

dards of Reporting Trials (CONSORT) guidelines for non-pharmacological treatment<sup>17</sup>.

## Procedures

Participants were instructed to avoid any physical exercise in the 24 hours prior to the assessments, maintain their usual diet, and avoid alcohol, coffee, and other stimulants on the same day as the assessments. Participants with hypertension continued to take their antihypertensive medications. Baseline assessment consisted of three morning visits (8:00-11:00 AM) to the laboratory at Porto Alegre Clinical Hospital. During the first visit, office BP was obtained after 20 minutes of seated rest, following standardized guidelines<sup>18</sup>. Participants then completed a standardized interview and underwent a comprehensive clinical evaluation, including clinical history, anthropometric assessment, resting electrocardiogram, and a sit-to-stand test to assess lower-limb muscle strength and functional performance. On the second visit, BP was reassessed, and participants completed functional capacity assessments (handgrip strength and cardiorespiratory fitness). All evaluations were performed by two independent assessors blinded to the interventions. The participants with hypertension maintained their current antihypertensive medications. The same assessments were repeated at the end of the intervention.

## Primary outcome measure

Office BP and heart rate (HR) were measured after 20-min of seated rest, according to standardized guidelines<sup>18</sup>. The participants were instructed to avoid physical exercises and alcohol ingestion 24-h prior to the exam. The measures were taken using a validated automatic oscillometric device (HBP-1100, OMRON Healthcare) and performed on both arms with a 1-min interval between measures. Then, measurements were performed twice on the arm with the highest systolic BP value. The mean of these two values was used to represent baseline BP. The lowest HR value was used to describe HR at rest and used to calculate rate-pressure product ( $RPP = \text{systolic BP} \times \text{HR}$ ), and the arm with the highest systolic BP value was used in post-intervention assessment for comparisons. Mean arterial pressure was calculated as  $(\text{diastolic BP} + 1/3(\text{systolic BP} - \text{diastolic BP}))$ .

## Secondary outcome measures

Secondary outcomes, including cardiorespiratory fit-

ness, the chair-stand test, and isometric handgrip strength, are thoroughly described in the original study's assessment procedures<sup>10</sup>.

## Intervention

The intervention took place on an outdoor beach tennis court at the School of Physical Education of the Federal University of Rio Grande do Sul (*Universidade Federal do Rio Grande do Sul* - UFRGS), Porto Alegre, Rio Grande do Sul, Brazil. Participants attended two sessions per week (either Monday/Wednesday or Tuesday/Thursday), with Friday reserved for make-up sessions.

The sessions were in pairs (i.e., 2 versus 2), lasting 45-60min each, and was composed of an initial period of 10min of warm-up using basic technical exercises (i.e., serve, volley, forehand, and backhand) followed by 3 sets of matches lasting 10-15min each (weeks 1-4: 3x10min; weeks 5-8: 3x12min; and weeks 9-12: 3x15min) with an interval of 2min between the sets. The matches were time-based rather than point-based to ensure that all participants played the same total time (min per session) throughout the intervention. The first week served as familiarization, during which basic rules and techniques were introduced. Based on these familiarization sessions, two research team members with previous experience in beach tennis classified each participant into three categories: beginner (poorly coordinated racket movements and little movement on the court), intermediate (more agile and coordinated movements), or advanced (broad dominance in all aspects of the game). Matches were scheduled based on performance level to ensure motivation and training intensity. The same two researcher team members supervised all training sessions and did not participate in further assessments and data analysis.

To assess training intensity, HR and rating of perceived exertion (RPE) were recorded during the first (week-1) and the last (week-12) week of training. The HR was monitored using a chest monitor (Polar H10, Kempele, Finland) and analyzed via PolarFlow software (Polar company, Kempele, Finland). The individual  $HR_{\text{max}}$  was estimated through Tanaka's Equation ( $=208-0.7 \times \text{age}$ )<sup>19</sup>. The  $HR_{\text{reserve}}$  was calculated using the following formula:  $(\text{exercise HR} - \text{HR at rest} / \text{HR}_{\text{reserve}}) \times 100$ . For RPE, the participant answered a simple question: "How was your training?" using the CR-10 Borg RPE-scale<sup>20</sup>.

Enjoyment levels were measured in the same weeks

using the Physical Activity Enjoyment Scale (PACES) questionnaire, completed 30 min post-exercise. The questionnaire includes 18 items rated on a 7-point bipolar scale, yielding scores from 18 to 126, with higher scores indicating greater enjoyment<sup>21</sup>.

Adherence was calculated as the number of attended sessions over the follow-up period.

### Classification of responders and non-responders

To assess inter-individual variability, participants were categorized as responders and non-responders based on the typical error of BP measurement (a measure of the variability or precision of repeated measurements). It was a measurement between BP test-retest, following the equation:  $SD_{\text{difference}}/\sqrt{2}$ , where  $SD_{\text{difference}}$ : in which the standard deviation of the differences in scores was calculated for the two tests performed within 24h at baseline<sup>22,23</sup>. Participants who showed reductions greater than the typical error were classified as responders.

### Statistical analyses

All randomized participants were included in a full analysis set, enabling intention-to-treat analyses. Participants who did not complete the study were also included in the analysis, with baseline assessment data carried forward to the outcome measures, except in the analysis of responders, for which both time points were required for calculation. Data were independently entered by two researchers and cross-verified. The statistician did not participate in the recruitment or assignment to the experimental sessions and was blinded to the interventions. Data distributions were analyzed using the Shapiro-Wilk test, which was combined with an analysis of histogram and Q-Q plots. Data were expressed as means and standard error for variables with normal distribution and delta values as means and 95% confidence intervals (95% CI). Generalized estimating equation analyses were used to assess the main effects for all outcomes across experimental interventions (beach tennis and control) over time in men and women (intervention\*time\*sex), adjusted for baseline values, diuretic use, height, body weight, and age, given the observed pre-intervention differences that may influence BP outcomes. Additionally, a complementary Generalized estimating equation analysis was performed to compare delta changes between groups (intervention\*sex), using the same set of covariates to ensure consistent adjustment for baseline differences and po-

tential confounding factors. Adjustment for multiple comparisons was accomplished using the Sequential Bonferroni test. Chi-square or Fisher's exact test to verify the association with the use of antihypertensive medication, sex, ethnicity, comorbidities, and rate of responders. Effect sizes were calculated using Cohen's  $d_z$  for within-group comparisons, and the interpretation of the effect size adopted was based on the following criteria: < 0.50, small; 0.50 to 0.79, medium; and  $\geq 0.80$ , large<sup>24</sup>. Statistical significance was accepted at  $p < 0.05$ . All analyses were conducted using SPSS Statistics for Windows, version 22.0 (IBM, Armonk, NY, USA).

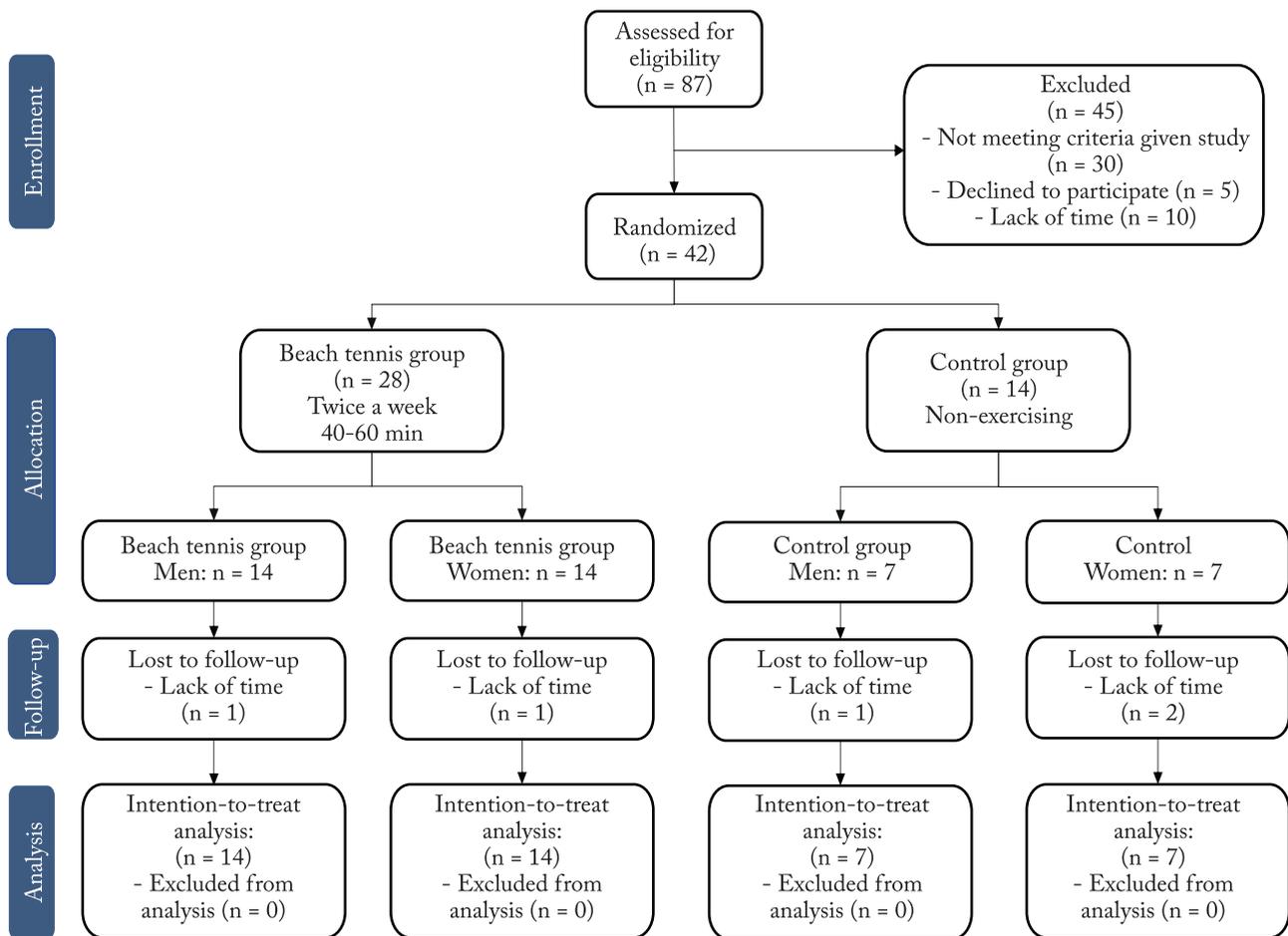
### Results

Figure 1 shows the participant flowchart. A total of 42 participants (men,  $n = 21$ ; women,  $n = 21$ ) were analyzed. The recruiting and follow-up ranged from February 2023 to March 2024. Five participants did not complete the post assessments (beach tennis group: men  $n = 1$ ; women  $n = 1$ , and control group: men  $n = 1$ ; women  $n = 2$ ). For the beach tennis groups, intervention attendance was similar between sexes, with 79% ( $18 \pm 5$  sessions) in men and 75% ( $18 \pm 5$  sessions) in women ( $p = 0.970$ ), of the 24 sessions offered. All participants were included in the intention-to-treat analysis.

Characteristics of the participants are presented in Table 1. Some baseline differences were observed between groups. In the control group, men had greater body mass than women ( $p = 0.012$ ). Within the beach tennis group, men were older ( $p = 0.036$ ), reported lower diuretic use ( $p = 0.006$ ) a pattern that is consistent with previous findings in the literature<sup>25</sup>, and exhibited lower resting HR values ( $p = 0.026$ ) compared with women. Men presented higher handgrip strength than women ( $p > 0.05$ ). And women demonstrated lower  $VO_{2\text{peak}}$  values than men ( $p = 0.017$ ).

### Beach tennis training sessions

During the 12-week beach tennis training period, matches were scheduled based on participants' performance level (beginners,  $n = 7\%$ ; intermediate,  $n = 57\%$ ; and advanced  $n=37\%$ ). Exercise intensity as indicated by average HR loading was greater during the first week than in the last week of training in men ( $124 \pm 5$  vs.  $111 \pm 5$  bpm,  $p = 0.001$ ) with tendency in women ( $134 \pm 5$  vs.  $121 \pm 4$  bpm,  $p = 0.084$ ). The participants reported a similar RPE (Borg scale CR-10) in Week 1 and Week 12 (Men:  $4 \pm 0$  AU [moderate] /  $4 \pm 0$  AU [moderate],  $p = 0.469$ ; Women:  $3 \pm 0$  AU [light] /  $3$



**Figure 1** – Flow diagram of participants

$\pm$  0AU [light],  $p = 0.517$ ). Moreover, enjoyment level (PACES scale) during beach tennis sessions remained consistent between the initial and final weeks of intervention (Men:  $119 \pm 3$  [94%] vs.  $121 \pm 3$  [96%],  $p = 0.428$ ; Women:  $125 \pm 1$  [99%] vs.  $126 \pm 1$  [100%],  $p = 0.195$ ). There were no reported neither injuries nor adverse events during the beach tennis sessions.

### Blood pressure, heart rate at rest, and rate pressure product

After the 12-week of beach tennis intervention, men demonstrated significant reductions across all hemodynamic variables ( $p < 0.001$ ), whereas women showed reductions in systolic BP ( $p = 0.036$ ), and RPP ( $p = 0.005$ ) when compared with baseline. Men in the control group showed an increase in resting HR ( $p = 0.001$ ), and both men and women in the control group exhibited increases in RPP ( $p = 0.013$  /  $p = 0.044$ , respectively) (Table 2). The delta BP values demonstrated that men and women of the beach tennis group showed greater reductions in systolic BP, but only

when compared with women in the control group ( $p = 0.014$  /  $p = 0.017$ , respectively) (Figure 2).

### Responders and non-responders to blood pressure

In the present study, considering the above-mentioned typical error calculation, we found a reduction of  $-5$  mmHg as the threshold for both systolic and diastolic BP responsiveness. For systolic BP, 62% of men and 46% of women were classified as responders, whereas 69% men and 54% of women for diastolic BP (Figure 3). No significant differences in rates of responders were observed between sexes for either systolic ( $p = 0.431$ ) or diastolic BP ( $p = 0.420$ ).

### Physical fitness

After training, a significant improvement in hand-grip strength was observed in men ( $p = 0.038$ ) but not in women in the beach tennis group. Lower-limb strength also improved in the beach tennis group, with men presenting positive results in the time required to

**Table 1** – Baseline characteristics of men and women in the beach tennis and control groups before the 12-week intervention program.

Variables	Men Beach Tennis (n = 14)	Men Control (n = 7)	Women Beach Tennis (n = 14)	Women Control (n = 7)
Age, years	55 ± 2*	53 ± 2	47 ± 2	51 ± 3
<b>Anthropometry</b>				
Body weight, kg	89 ± 3	94 ± 4#	88 ± 5	76 ± 4
Height, cm	172 ± 13	172 ± 13	165 ± 23	165 ± 23
Body mass index, kg/m <sup>2</sup>	30 ± 1	30 ± 1	32 ± 2	30 ± 1
Waist circumference, cm	103 ± 3	105 ± 3	99 ± 3	95 ± 5
<b>Etnicity, n (%)</b>				
White	13 (87)	13 (87)	12 (80)	12 (80)
Black	2 (13)	2 (13)	3 (20)	3 (20)
<b>Anti-hypertensive medications, n (%)</b>				
Diuretics	2 (14)*	2 (29)	10 (71)	4 (57)
β blockers	3 (21)	1 (14)	1 (7)	1 (14)
Angiotensin II receptor blockers	7 (50)	4 (57)	8 (57)	4 (57)
Calcium channel blockers	4 (29)	2 (43)	4 (29)	1 (14)
Angiotensin converting enzyme inhibitors	4 (29)	1 (29)	3 (21)	0 (0)
Combined Therapy	5 (36)	4 (57)	9 (64)	3 (43)
<b>Comorbidities, n (%)</b>				
Diabetes mellitus	1 (7)	0 (0)	3 (21)	2 (33)
Hypercholesterolemia	5 (36)	5 (71)	7 (50)	4 (57)

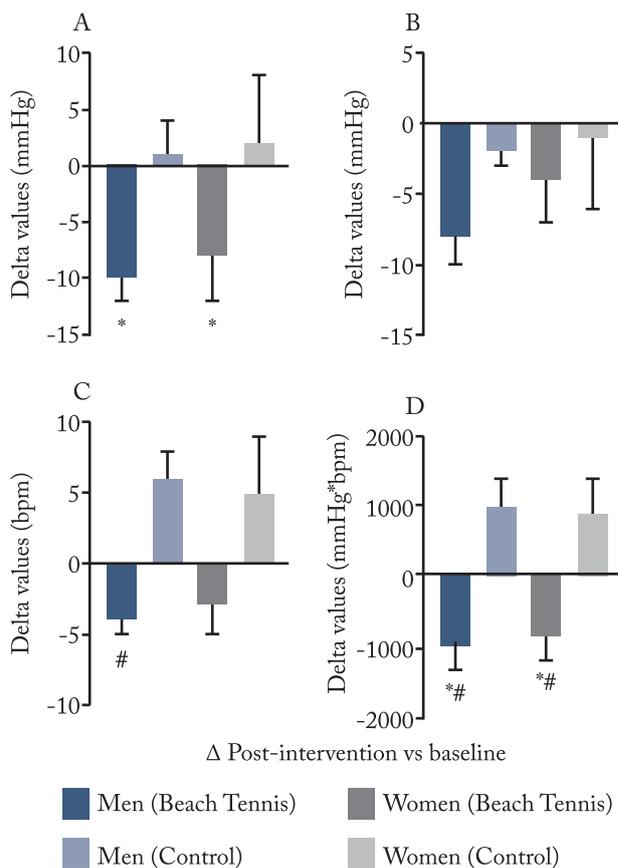
Values are mean ± SD or number (percentagem). \*Indicates a significant difference from women in the beach tennis group (P < 0.05).

complete the first five repetitions (p = 0.012) and the total number of repetitions performed in 30 seconds (p = 0.003), and women improvements only in the 30-second chair-stand test (p = 0.039). Participants in the control group of both sexes did not show improvement in the neuromuscular outcomes. For cardiorespiratory fitness, no significant differences were observed between groups Table 3. Figure 4 presents the compar-

**Table 2** – Office hemodynamic measurements at baseline and after the 12-week intervention program

Variables	Men Beach Tennis (n = 14)			Women Beach Tennis (n = 14)			Men Control (n = 7)			Women Control (n = 7)		
	Baseline	Final	p value	Baseline	Final	p value	Baseline	Final	p value	Baseline	Final	p value
Systolic blood pressure (mmHg)	136 ± 3	126 ± 2	<0.001	128 ± 2	121 ± 3	0.036	132 ± 5	133 ± 6	0.808	132 ± 4	135 ± 5	0.581
Diastolic blood pressure (mmHg)	85 ± 2	77 ± 1	<0.001	81 ± 1	77 ± 2	0.082	83 ± 3	82 ± 2	0.138	83 ± 4	84 ± 5	0.821
Mean arterial pressure (mmHg)	102 ± 2	95 ± 2	0.010	97 ± 1	92 ± 2	0.045	100 ± 4	99 ± 4	0.512	99 ± 3	101 ± 5	0.749
Heart rate (bpm)	70 ± 2*	66 ± 2	0.007	80 ± 3	77 ± 2	0.156	67 ± 4	74 ± 5	0.001	74 ± 3	80 ± 6	0.166
Rate-pressure product (mmHg*bpm)	9515 ± 427	8502 ± 373	0.002	10246 ± 391	9360 ± 432	0.007	8919 ± 718	9901 ± 971	0.013	9760 ± 522	10728 ± 745	0.044

Variable values are presented as mean ± SE. Delta values and between-Group difference are expressed as mean (95% confidence intervals). \*Indicates a significant difference from women in the beach tennis group (p < 0.05). Bold p-values indicate significant results at baseline (p < 0.05).

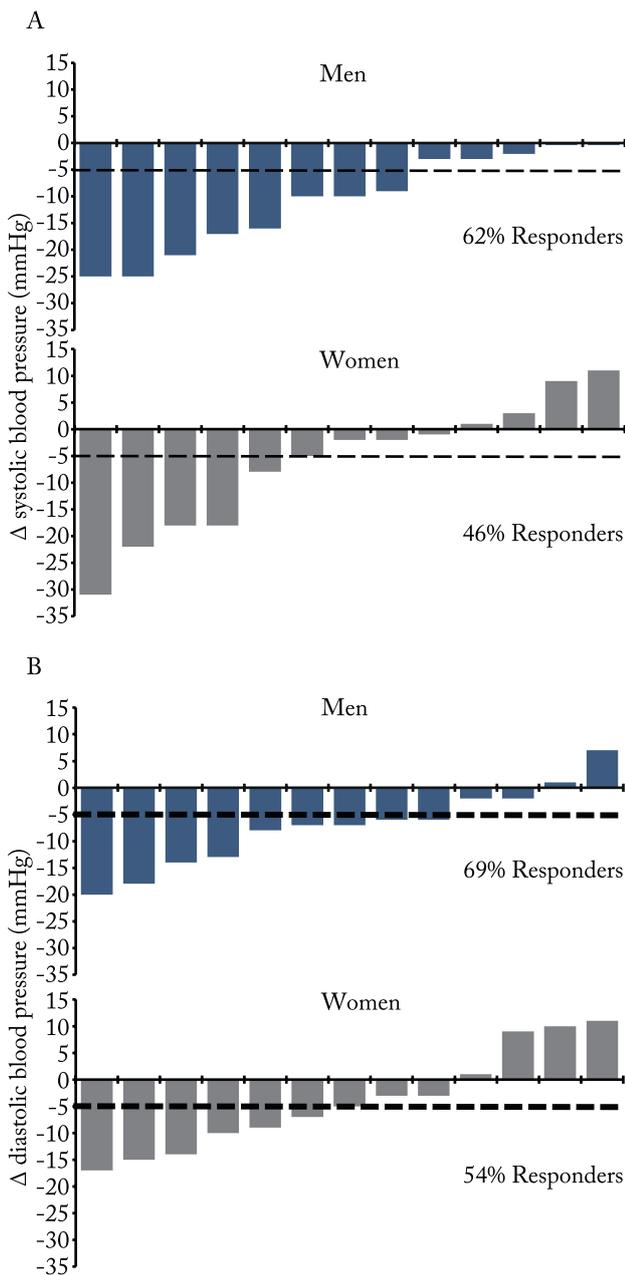


**Figure 2** – Differences in values between post-training and baseline (Δ) in men and women participating in the beach tennis and control groups. (A) Systolic blood pressure; (B) Diastolic blood pressure; (C) Heart rate; (D) Rate-pressure product. Data are presented as mean ± standard error. \*Indicates difference from women of the control group (p < 0.05). #Indicates difference from men of the control group (p < 0.05).

ison of delta values between the groups, indicating no significant differences.

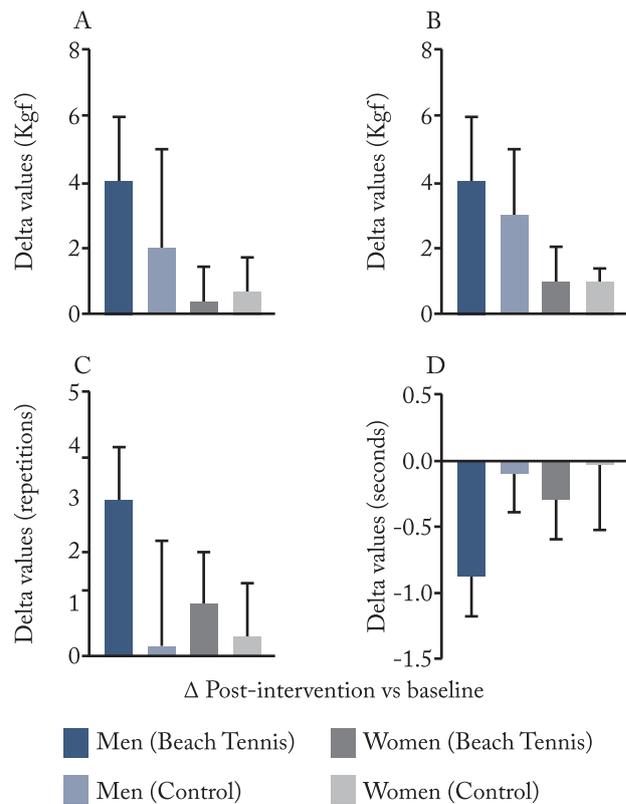
## Discussion

The main finding of this exploratory study is the obser-



**Figure 3** – Individual changes in systolic (A) and diastolic (B) blood pressure (final minus baseline) in 13 men and 13 women who underwent pre- and post-intervention assessments. Dashed line: minimal detectable change (5 mmHg).

vation that a 12-week beach tennis program appeared to lower BP in men and women patients with treated hypertension. This preliminary finding underscores the potential of beach tennis as a feasible, easy-to-learn, and accessible exercise modality for lowering BP in both men and women. Interestingly, some potential sex-based differences were noted since men exhibited a higher responder rate and showed improvement across all neuromuscular outcomes. Given the exploratory nature of these data, robust, prospective studies with larger



**Figure 4** – Differences in values between post-training and baseline ( $\Delta$ ) in men and women participating in the beach tennis and control groups. (A) Handgrip strength in the dominant arm; (B) Handgrip strength in the non-dominant arm; (C) 30-s chair stand; (D) 5-times chair stand. Data are presented as mean  $\pm$  standard error.

sample sizes and designs specifically powered to investigate this potential discrepancy are warranted to either confirm or refute this hypothesized differential effect.

A 12-week recreational beach tennis intervention reduced systolic (-10 mmHg) and diastolic BP (-8 mmHg) in men with treated hypertension. Among women, systolic BP decreased (-7 mmHg), and values were 13 mmHg lower at the end of the study compared with those in the control group. The magnitude of BP reduction is comparable to the effects reported in a meta-analysis of 17 studies on recreational football with a similar training volume and duration<sup>26</sup>. In contrast, other recent studies evaluating recreational football<sup>27</sup> and futsal<sup>28</sup> fail to show reductions on BP in participants using antihypertensive medication. Importantly, a reduction of approximately 10 mmHg in systolic BP is clinically meaningful, being associated with a 20% lower risk of major cardiovascular events, a 17% reduction in coronary heart disease, and a 27% decrease in stroke risk<sup>29</sup>. This finding is particularly noteworthy given that the cohort consisted of patients already undergoing pharmacological treatment for hypertension.

**Table 3** – Physical fitness measurements at baseline and after the 12-week intervention program

Variables	Men Beach Tennis (n = 14)			Women Beach Tennis (n = 14)			Men Control (n = 7)			Women Control (n = 7)		
	Baseline	Final	p value	Baseline	Final	p value	Baseline	Final	p value	Baseline	Final	p value
Handgrip test												
Dominant arm (kg)	51 ± 2*#	54 ± 2	0.038	37 ± 2	37 ± 2	0.741	51 ± 3*#	53 ± 3	0.459	32 ± 3	33 ± 2	0.542
Non-dominant arm (kg)	49 ± 2*#	53 ± 3	0.010	33 ± 2	34 ± 2	0.400	46 ± 4*#	49 ± 3	0.203	33 ± 2	34 ± 1	0.068
30s Chair-stand test												
Repetitions	22 ± 1	25 ± 1	0.012	22 ± 1	23 ± 1	0.039	22 ± 1	22 ± 2	0.899	20 ± 2	20 ± 2	0.695
Five-time (s)	7 ± 0	6 ± 0	0.003	7 ± 0	7 ± 1	0.361	7 ± 1	7 ± 1	0.786	8 ± 1	8 ± 1	0.608
Cardiorespiratory fitness												
Peak VO <sub>2</sub>	31 ± 2*	32 ± 1	0.407	26 ± 1	26 ± 1	0.705	30 ± 1	32 ± 2	0.063	28 ± 2	26 ± 2	0.050

Variable values are presented as mean ± SE. Delta values and between-Group difference are expressed as mean (95% confidence intervals). BP: blood pressure (mmHg); AP: arterial pressure (mmHg); Heart rate (bpm); RPP: Rate-pressure product (mmHg\*bpm); \*Indicates a significant difference from women in the beach tennis group ( $p < 0.05$ ). #Indicates a significant difference from women in the control group ( $p < 0.05$ ). Bold p-values indicate significant results at baseline ( $p < 0.05$ ).

We found only one previous investigation that compared the BP responses between sexes after a recreational sport intervention. In that study, men and women with prediabetes engaged in recreational football twice weekly combined with dietary counseling for 16 weeks. Similarly to our study, men and women presented similar BP reductions<sup>30</sup>. The magnitude of physiological adaptations to exercise varies across individuals and sexes undergoing the same training program<sup>31</sup>. Some individuals (responders) exhibit a reduction in BP, while others maintain or even increase their BP (non-responders)<sup>32,33</sup>. In our study, 62% of men and 46% of women were classified as responders for systolic BP, corresponding to 38% of men and 54% of women as non-responders. These results align with a recent study showing that after 12-weeks of continuous aerobic training, 67% of women were considered non-responders for systolic BP<sup>34</sup>. In the same study, women classified as non-responders after more 12-weeks of training became responders when exercise volume was increased (60%) or when high-intensity interval training was applied (100%), suggesting that women may require greater training loads to achieve BP reductions. However, considering the exploratory characteristic of these studies, a larger randomized controlled trial, with the primary focus on the potential differences between men and women, is mandatory.

The RPP, which is a reliable surrogate measure of myocardial oxygen consumption and cardiac workload, is strongly associated with left ventricular mass and ischemic events, including myocardial infarction<sup>35</sup>. The literature suggests that the threshold for cardiovascular disease and all-cause mortality is higher than 9,488 mmHg\*bpm<sup>35</sup>. In our study, men and women allocated

to the beach tennis group began the training intervention with RPP above the cardiovascular risk threshold (9,515 and 10,246 mmHg\*bpm, respectively). After training, both groups presented values below this threshold, with reductions of 1,013 and 886 mmHg\*bpm for men and women, respectively. In contrast, participants in the control group showed a significant worsening in RPP, with men increasing by 982 mmHg\*bpm and women by 968 mmHg\*bpm, in this way remaining above the cardiovascular risk threshold. These findings highlight the potential of recreational beach tennis as an effective non-pharmacological strategy to reduce cardiac workload and mitigate cardiovascular risk in men and women with treated hypertension.

Higher levels of upper- and lower-body muscular strength are associated to lower mortality risk in adults, regardless of age and follow-up period<sup>36</sup>. A recent study utilizing multicomponent exercises performed twice weekly over 10-weeks demonstrated improvements in the 30" chair stand test (lower-body strength) and handgrip strength (upper-body strength) in adults with cardiovascular disease<sup>37</sup>. These findings are consistent with our results, where both men and women improved their performance on the chair stand test after 12-weeks of beach tennis. However, only men demonstrated significant improvements in handgrip strength in both arms. This is consistent with a study on multicomponent recreational team handball training, which did not report improvements in handgrip strength among women after 16-weeks of training<sup>38</sup>. Regarding VO<sub>2max</sub>, it was expected that improvements would follow the 12-week program, given the aerobic and anaerobic demands of the sport<sup>39</sup>. However, contrary to expectations, no significant increases in VO<sub>2max</sub> were observed

after training, suggesting that the intensity and volume of training may not have been sufficient to elicit cardiorespiratory fitness adaptations in men and women.

Another important aspect to consider in sports training is an individual's motivation and enjoyment, as these are significant factors influencing their participation in sporting activities and the feasibility of a training concept<sup>40</sup>. Although motivation was not directly assessed in the present study, a previous study suggested that women often report lower interest and enjoyment compared to men<sup>7</sup>. A noteworthy result of this study is the high enjoyment level reported from the first week of beach tennis training, with continued improvement over time, culminating in 100% enjoyment levels reported by women in the final session. These results indicate that beach tennis may serve as an effective strategy for increasing long-term engagement in physical activity, particularly among women.

This study presents limitations that should be considered. The exploratory, post-hoc nature of this specific analysis constitutes a primary limitation. The small sample size reflects the scope of the original trial<sup>10</sup>, reducing the statistical power of the current analyses. Nonetheless, the study also has strengths. The absence of injuries or adverse effects during the beach tennis program and the assessment of cardiovascular demand during the practice indicate the safety and feasibility of the intervention for men and women with hypertension. Furthermore, the high enjoyment reported by participants, combined with measurable cardiovascular benefits, underscores the feasibility and potential long-term adherence to beach tennis training, especially among women.

In summary, a 12-week recreational beach tennis training seems to induce similar BP reductions in men and women with hypertension. Nonetheless, the preliminary findings regarding distinct neuromuscular and hemodynamic responses between sexes highlight the need for further, well-powered studies designed to either confirm or refute these potential sex-based differences and guide the optimal prescription of beach tennis as an exercise intervention for men and women with hypertension.

### Conflict of interest

The authors declare no conflict of interest.

### Funding

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### Author's contributions

Carpes LO: Conceptualization, Methodology, Investigation, Data curation; Funding acquisition, Writing – original draft; Writing – review & editing; Approval of the final version. Jung N and Domingues LB: Methodology; Investigation; Funding acquisition; Writing – review & editing; Approval of the final version. Bastos R and Ramos D: Investigation, Writing – review & editing; Approval of the final version. Mohr M: Visualization; Writing – review & editing; Approval of the final version. Ferrari R: Conceptualization; Methodology; Validation; Formal analysis; Investigation; Data curation; Supervision; Project administration; Visualization; Funding acquisition; Writing – original draft; Writing – review & editing; Approval of the final version.

### Declaration regarding the use of artificial intelligence tools in the article writing process

The authors did not use artificial intelligence tools for preparation of the manuscript.

### Availability of research data and other materials

After publication the data will be available on demand to authors

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# Reviewers' assessment

The reviews of this article were originally conducted in Portuguese. This version has been translated using ChatGPT and subsequently reviewed by the Chief Editors.

## Reviewer A

Anonymous

### Format

- Does the article comply with the manuscript preparation rules for submission to the Revista Brasileira de Atividade Física & Saúde?  
Yes
  - Regarding formal aspects, is the manuscript well structured, containing the sections: introduction, methods, results, and discussion (with the conclusion as part of the discussion)?  
Yes
  - Is the language appropriate, and is the text clear, precise, and objective?  
Yes
  - Was any indication of plagiarism observed in the manuscript?  
No
- Suggestions/Comments:**
- No suggestions.

### Abstract

- Are the abstract and the abstract in English adequate (including: objective, information about the study participants, variables studied, main results, and a conclusion) and do they reflect the content of the manuscript?  
No
- Suggestions/Comments:**
- The abstract presents some flaws in its construction. First, there is an absence of an introduction; the text begins directly with the objective. Another important point concerns the journal's guidelines: the sections should be clearly demarcated as Introduction, Objective, Methodology, Results, and Conclusion. However, this structure is not present in the text.
  - In addition, the descriptors need adjustments. The descriptor racket sports should be correctly written as racquet sports. It is suggested to replace recreational sports, as this description does not appear in DeCS and is only presented as recreational facilities. The same applies to sand sports, a term that

does not have a corresponding descriptor. Therefore, it is recommended that this descriptor be replaced or removed.

### Introduction

- Was the research problem clearly stated and delimited?  
Yes
- Is the research problem adequately contextualized in relation to existing knowledge, moving from the general to the specific?  
Yes
- Are the reasons justifying the need for the study (including the authors' assumptions about the problem) well established in the text?  
Yes
- Are the references used to support the presentation of the research problem current and relevant to the topic?  
Yes
- Was the objective clearly presented?  
Yes

### Suggestions/Comments:

- Page 2, lines 6 and 7: the percentages related to treatment seem confusing. The text itself already conveys the main idea; therefore, I suggest revising this excerpt to make it clearer and easier to understand.
- Between lines 10 and 17, the text states that women show lower adherence, which may give the impression that the study is directed exclusively at this population. It is recommended to reassess this section to avoid such an interpretation.
- Was a sample size calculation performed specifically for this study?
- Page 3, line 2 introduces the term "hybrid sports." I suggest including an example of a hybrid sport to facilitate reader understanding.

### Methods

- Are the methodological procedures, in general, appropriate for studying the research problem?  
Partially
- Are the methodological procedures adopted for

conducting the study sufficiently detailed?

Yes

- Was the procedure used for participant selection or recruitment appropriate for the problem studied and described in a sufficient, clear, and objective manner?

Partially

- Were information about the instruments used for data collection, their psychometric properties (e.g., reproducibility, internal consistency, and validity), and, when relevant, the operational definition of variables presented?

Yes

- Is the data analysis plan appropriate and adequately described?

Yes

- Were the inclusion and/or exclusion criteria for participants described and appropriate for the study?

Partially

- Did the authors provide clarification regarding the ethical procedures adopted for conducting the research?

Partially

#### **Suggestions/Comments:**

- Page 4, line 7 contains the text Institutional Review Board of XXXX, Brazil (GPPG-FIPE registry: XXXX). If the approval number does not exist or was not provided, this gives the impression that the project was not approved to conduct the study. I suggest adding the corresponding approval number.
- Page 4, line 19 mentions the sit-to-stand test. However, it is not clear for what purpose this test was used. It is recommended to clarify its objective within the study.
- Page 5, between lines 20 and 24, the duration of the sessions is explained. Why was this session duration and its progression chosen instead of a match-based model with point counting, which is the usual format of the modality?
- Page 7, line 4 presents the study sample size. It is recommended to include this information at the beginning of the Methods section, together with the description of the study design and the inclusion and exclusion criteria.
- Page 7, line 21, I suggest replacing the term “sex” with “gender.”

## **Results**

- Is the use of tables and figures appropriate and does

it facilitate the adequate presentation of the study results?

Yes

- Is the number of illustrations in the article consistent with the journal’s submission guidelines?

Yes

- Are the number of participants at each stage of the study, as well as the number and reasons for losses and refusals, presented in the manuscript?

Partially

- Are participant characteristics presented and sufficient?

Yes

- Are the results adequately presented, highlighting the main findings and avoiding unnecessary repetition?

Yes

#### **Suggestions/Comments:**

- In Figure 1, I suggest specifying what is included under the category “other reasons,” as this classification is very generic. Detailing the reasons for dropout may be relevant and open possibilities for future research to explore these factors within the context of the modality.
- In the tables, delta values are presented for some variables, accompanied by the term in parentheses “(value to value).” However, this notation is not clear. I question whether these refer to mean and standard deviation values. If so, I recommend using the conventional notation applied to variables (e.g., mean  $\pm$  SD) to maintain standardization and facilitate understanding. If this is not the intention, I suggest clarifying more objectively what this form of presentation aims to convey.

## **Discussion**

- Are the main findings of the study presented?

Yes

- Are the limitations and strengths of the study presented and discussed?

Yes

- Are the results discussed in light of the study’s limitations and the existing knowledge on the subject?

Partially

- Are the potential contributions of the main findings to scientific development, innovation, or real-world intervention discussed by the authors?

Partially

#### **Suggestions/Comments:**

- Why do the authors believe that men were more responsive than women to the practice of the modality? I recommend discussing possible physiological, behavioral, or methodological factors that may have influenced this result.
- When stating that Beach Tennis is an accessible modality, considering the context of the country where the study was conducted, how was this claim controlled or substantiated? Was there any economic, demographic, or social criterion or analysis supporting this statement?
- On page 10, line 17, it is mentioned that there is a reduction of 10 mmHg for men and 8 mmHg for women. However, the wording suggests an increase in these blood pressure values. I suggest changing this to “-10 mmHg” and “-8 mmHg,” or using clearer wording such as “a reduction of 10 mmHg” and “a reduction of 8 mmHg.” The same adjustment is recommended for line 19.
- The discussion addresses the use of antihypertensive medications. In this regard, it is questioned how the authors controlled this variable. Was there any stratification of participants according to medication class? Was the statistical model (GEE) adjusted considering the type of medication? The statistical description does not specify this factor. Additionally, how do the authors justify that the observed blood pressure reduction is exclusively due to training, rather than the isolated effect of medication or the combined effect of training and pharmacological treatment?
- On page 12, line 21, the authors mention that motivation is a relevant factor for adherence to the modality. However, was this factor actually measured or methodologically considered in the study? The argument is pertinent, but it was not evaluated within the scope of the research. Therefore, it is suggested to clarify the purpose of this point in the discussion, since it is not a variable directly analyzed.

## Conclusion

- Was the study conclusion presented appropriately and is it consistent with the study objective?  
Yes
- Is the study conclusion original?  
Yes

### Suggestions/Comments:

- No suggestions.

## References

- Are the references current and sufficient?  
Yes
- Is most of the reference list composed of original research articles?  
Yes
- Do the references comply with the journal's guidelines (quantity and format)?  
Yes
- Are in-text citations appropriate, meaning that the statements in the text cite references that actually support those statements?  
Yes

### Suggestions/Comments:

- No suggestions.

## Comments to the author

- The study proposal is relevant and contributes to the discussion of a modality that is highly popular in Brazil. However, there are still important gaps in the abstract, methodology, and discussion that need to be clarified so that the study achieves greater robustness and is better understood.
- In particular, it is essential to detail how the classification of antihypertensive medications was performed and how this variable was incorporated or controlled in the statistical analysis, especially in the GEE model. In addition, it is crucial to include the sample size calculation in the methodology section, clearly informing the parameters used for its determination.
- It would also be important to further deepen the discussion regarding the reasons why men were more responsive than women in the analyzed outcomes.
- Finally, although motivation is mentioned in the discussion as a relevant factor, it was not directly assessed in the study. This requires better contextualization of its inclusion in the text or, alternatively, a clear delimitation that it represents only a theoretical reflection, not a finding of the present study.

## Final decision

- Substantial revisions required

## Reviewer B

Wagner Prado 

California State University San Bernardino, California, United States.

This manuscript addresses an interesting and timely

question regarding the effects of recreational sport on blood pressure and fitness in individuals with hypertension. However, upon closer examination, there are substantial methodological and reporting issues that limit the validity and transparency of the findings. In particular, the study is presented as a secondary analysis of a randomized controlled trial, but the design more closely resembles a post-trial, uncontrolled follow-up intervention that was not pre-registered. Additional concerns include unclear participant recruitment and assessment procedures, lack of detail in outcome reporting, and unregistered subgroup analyses. My detailed comments are provided below.

### Major concerns

- Although the manuscript frames this work as a “secondary analysis,” the description of participant flow indicates that it is essentially a post-trial, single-arm follow-up intervention. After the original trial, only two control participants completed the intervention alongside the initial intervention group, leaving no valid comparator group. Importantly, this extension phase does not appear in the original clinical trial registration, raising concerns about transparency and selective reporting. Furthermore, the analyses comparing men and women were not pre-specified in the trial registry, suggesting they may be exploratory and unplanned. Introducing unregistered analyses, especially subgroup comparisons, without clear justification undermines confidence in the results and raises ethical concerns regarding adherence to pre-registered protocols and reporting standards (CONSORT, ICMJE). For clarity and integrity, the authors should explicitly acknowledge that this study is a non-randomized follow-up, not a secondary analysis of the RCT, and should discuss the absence of trial registration for this phase and for the sex-based comparisons.

### Specific comments

- In the original trial, there were two groups: beach tennis (n=28) and control (n=14).
- After the trial ended, the control group was invited to also try the intervention. However, only 2 controls actually completed it.
- The “current study” then combines those 2 with the 28 originally assigned to the intervention → effectively a single-arm intervention study with n=30.
- There is no remaining comparator group and no

randomization preserved.

- Calling it a “secondary analysis” is misleading, because the design is closer to an open-label follow-up intervention study or a post-trial extension, not a re-analysis of the RCT data.
- This has big implications:
  - Internal validity: Without a control group, any observed effects cannot be attributed to the intervention alone.
  - Terminology: The methods section should not frame this as a “secondary analysis of the RCT,” but rather as an extension study (or “post-trial intervention study”).
  - Transparency: The authors should explicitly state that this analysis lacks a randomized control group and is exploratory in nature.

### Final decision

- Resubmit for Review

### Reviewer C

Luan Morais Azevêdo 

Federal University of Mato Grosso do Sul, Campo Grande, Brazil

### Format

- Does the article meet the manuscript preparation rules for submission to the Revista Brasileira de Atividade Física e Saúde?  
Yes
- Regarding formal aspects, is the manuscript well structured, containing the sections: introduction, methods, results, and discussion (with the conclusion as part of the discussion)?  
Yes
- Is the language appropriate, and is the text clear, precise, and objective?  
Yes
- Was any indication of plagiarism observed in the manuscript?  
No

### Suggestions/Comments:

- The manuscript is in the format required for publication in this journal. However, I would like to suggest that the authors make one more revision before publication. For example, on line 13 of page 12, “both men and ?? improved...”. I think “women” is missing.

### Abstract

- Are the abstract and the abstract in English adequate (containing: objective, information about the study participants, variables studied, main results, and a conclusion) and do they reflect the content of the manuscript?

Partially

**Suggestions/Comments:**

- It's confusing to read the title "middle-aged" and then look at the summary and see "aged 35–65 years".

## Introduction

- Was the research problem clearly stated and delimited?

Yes

- Is the research problem adequately contextualized in relation to existing knowledge, moving from the general to the specific?

Yes

- Are the reasons justifying the need for the study (including the authors' assumptions about the problem) well established in the text?

Yes

- Are the references used to support the presentation of the research problem current and relevant to the topic?

Yes

- Was the objective clearly presented?

Yes

**Suggestions/comments:**

- None.

## Methods

- Are the methodological procedures, in general, appropriate for studying the research problem?

Partially

- Are the methodological procedures adopted for conducting the study sufficiently detailed?

Partially

- Was the procedure used for participant selection or recruitment appropriate for the problem studied and described in a sufficient, clear, and objective manner?

Yes

- Were information about the instruments used for data collection, their psychometric properties (e.g., reproducibility, internal consistency, and validity), and, when relevant, the operational definition of variables presented?

Yes

- Is the data analysis plan appropriate and adequately described?

Yes

- Were the inclusion and/or exclusion criteria for participants described and appropriate for the study?

Yes

- Did the authors provide clarification regarding the ethical procedures adopted for conducting the research?

Yes

**Suggestions/Comments:**

- Usually, 3 blood pressure measurements are taken to obtain the average and an error of 4 mmHg between measurements. Why did the authors take only 2 measurements and adopt an error of 5 mmHg?

## Results

- is the use of tables and figures appropriate and does it facilitate the adequate presentation of the study results?

Partially

- Is the number of illustrations in the article consistent with the journal's submission guidelines?

Yes

- Are the number of participants at each stage of the study, as well as the number and reasons for losses and refusals, presented in the manuscript?

Yes

- Are participant characteristics presented and sufficient?

Yes

- Are the results adequately presented, highlighting the main findings and avoiding unnecessary repetition?

Yes

**Suggestions/Comments:**

- Figures 2 and 3 do not have the title of the Y axis. There are 14 bars, and it's confusing to know whether each bar represents a BP measurement or a week of training.

- Under Limitations, you mention adherence. I haven't seen any results/frequency regarding adherence. I would like to see this data. For example: "Adherence to training sessions was similar/different and greater/less than xx% in both training groups and training intensity increased/decreased similarly/differently and as planned in both groups....."

## Discussion

- Are the main findings of the study presented?  
Yes
- Are the limitations and strengths of the study presented and discussed?  
Yes
- Are the results discussed in light of the study's limitations and the existing knowledge on the subject?  
Yes
- Are the potential contributions of the main findings to scientific development, innovation, or real-world intervention discussed by the authors?  
Yes

### Suggestions/Comments:

- I would like to suggest removing lines 6 to 8 on page 9: "There was no sex difference in terms of heart rate and RPE during both Week 1 and Week 12. Nonetheless, there was a tendency for women to exhibit higher levels of enjoyment compared to men in both Week-1 (P=0.088) and Week-12 (P=0.072)." I think this is far from being a "tendency".

## Conclusion

- Was the study conclusion presented appropriately and is it consistent with the study objective?  
Yes
- Is the study conclusion original?  
Yes

### Suggestions/comments:

- None.

## References

- Are the references current and sufficient?  
Yes
- Is most of the reference list composed of original research articles?  
Yes
- Do the references comply with the journal's guidelines (quantity and format)?  
Yes
- Are in-text citations appropriate, meaning that the statements in the text cite references that actually support those statements?  
Yes

### Suggestions/comments:

- None.

## Comments to the author

- Congratulations on your work. My suggestions are

attached and I hope I can make a positive contribution to this work.

## Final decision

- Minor revisions required

## Section Editor's considerations

Marilia de Almeida Correia 

Universidade Nove de Julho, São Paulo, São Paulo, Brazil.

Dear Authors,

Please find below additional comments to those provided by the reviewers:

## Methods

- It is requested that, in the revised version of the manuscript, a review be carried out in accordance with the CONSORT items, ensuring that all of them are addressed. In addition, it is necessary to attach the completed checklist as a separate document.
- In the manuscript submission form, it is stated that the study protocol was not registered. However, the article cited as "primary" refers to a registration in ClinicalTrials (NCT03909321) and to a protocol paper (DOI: 10.1186/s12889-020-10117-5). We would like clarification as to whether these records refer to the same dataset used in the present manuscript. If so, it is suggested that this information be explicitly stated to ensure greater transparency.
- In the "Procedures" item of the Methods section, it is mentioned that "All evaluations were performed by two independent assessors blinded to the interventions." However, the manuscript gives the impression that only the intervention group (beach tennis) was evaluated, with exclusion of the control group. Is this interpretation correct?
- In the "Sample size" item, it is not clear why data from the control group were not considered. Excluding this group may generate important biases in the interpretation of the results, since without the inclusion of a control group, uncertainty remains as to whether the observed effects are truly due to the training or to other factors, such as natural variability, time effects, or participants' expectations. The control group is essential to provide a valid basis for comparison and to ensure greater robustness of the study's conclusions.
- Still within this item, it is important to highlight

that the use of data from the control group after offering the intervention may introduce bias, since at this second moment there is no longer maintenance of randomization or blinding and participants present different exposure times. Therefore, it is recommended that the authors reconsider this choice or, at least, clearly state this limitation in the analysis.

- In the “Statistical analyses” item, I had doubts regarding two points: (i) it is mentioned that the statistician was blinded to the intervention, but considering that the study presents only one intervention group, would this information not be inconsistent?; and (ii) the use of the GEE model with an intervention factor is mentioned, but it was not clear how this was applied within the described design. Could these aspects be clarified?
- Still in the “Statistical analyses” item, it is not clear which method was used for the intention-to-treat analysis.

## Results

- Differences were observed in baseline sample characteristics, which should be taken into account when interpreting response comparisons. In particular, variables such as age, height, and use of diuretics stand out, as they are directly related to blood pressure values and their responses to physical exercise. The most appropriate approach would be to weight or adjust the analyses for these differences in order to reduce possible biases in the interpretation of the results.
- The figures present a ‘net effect’ on the Y axis, but there is no description in the Methods section of how this net effect was calculated. Is it possible that the figures are actually showing only the deltas (post–pre differences) of blood pressure responses?
- In addition, the figures present 14 bars for women and 14 for men; however, the Methods section states that the analysis would follow the intention-to-treat principle. For these figures, were participants who dropped out of the study not included? If they were excluded, this information needs to be explicitly stated in the text.
- Based on the organization of the tables presented, it can be inferred that paired-sample mean compari-

son tests were performed for within-group analyses (women pre vs. women post; men pre vs. men post) and independent-sample mean comparison tests were performed for between-group analyses (men’s delta vs. women’s delta). Is this interpretation correct? If so, please clarify to which data the GEE was applied, as mentioned in the statistical analysis section. It is also requested that this section be adjusted to accurately reflect the statistical procedures that were actually used.

## Discussion

- The first paragraph of the discussion begins with the statement: “The main finding of the present study is that a 12-week beach tennis program effectively lowered BP in men and women patients with treated hypertension, with more men classified as responders, and a higher effect size in men compared to women.” As a researcher, I consider that greater caution is necessary in these conclusions.
- First, the statement that there was a reduction in blood pressure should be interpreted with great caution, as the absence of a control group makes it impossible to ensure that the observed decrease resulted exclusively from the intervention. Without this comparison group, the influence of external factors, such as time effects, spontaneous blood pressure variations, or even a placebo effect, cannot be ruled out.
- Second, the conclusion that men were more responsive than women also requires caution. It is essential to clarify whether a specific statistical analysis was performed to support this statement. Otherwise, the interpretation may be weak. In this regard, it is suggested that a test (for example, a chi-square test) be applied to compare the proportions of responders between sexes, which would provide greater robustness and transparency to the conclusion presented.
- In the fourth paragraph of the discussion, there appears to be an error in the statement: “In our study, 43% of men were classified as non-responders, compared to 57% of women.” Please review this excerpt.