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Effects of Combined Exercise Training on Tumor Blood Flow Assessed by Doppler Ultrasound in Breast Cancer

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Background: Breast tumors exhibit abnormal vasculature characterized by low perfusion, impaired oxygenation, and reduced drug delivery. Combined training (CT), in turn, may modulate the tumor microenvironment by enhancing vascularization, perfusion, and metabolic signaling. **Objectives:** To determine the effects of pre-treatment CT on (a) tumor blood-flow parameters - peak systolic velocity (PS), end-diastolic velocity (ED), resistance index (RI), heart rate (HR), and intratumoral vessel diameter in women with breast cancer. **Methods:** Twenty-two patients were included. After randomization, participants were allocated to either the CT or control (CG) groups and were assessed within their respective groups at both pre- and post-intervention time points. Tumor blood flow parameters were assessed before and immediately after the first and last training session, using Doppler ultrasound. CT consisted of five resistance exercises (8–12 RM) followed by high-intensity interval training on an ergometric bicycle (3–5 × 2 min at $\Delta 50\%$ with 2 min of active recovery, twice per week). CG performed passive stretching. A linear mixed-effects model was applied to compare groups and time points, followed by Fisher's LSD post hoc comparisons. Patients performed at least 6 training sessions. **Results:** In the first training session, no significant changes were identified for PS, ED, RI, or HR (all $p > 0.05$), indicating no acute modulation of tumor blood flow at this early stage. Comparing the baseline (pre-first training session vs pre-last training session) values of tumor blood-flow parameters, it was observed a significant increase in systolic intratumoral flow over the intervention period (CT: 11.03 ± 9.40 to 19.78 ± 8.75 ; CG: 11.59 ± 2.50 to 10.29 ± 4.13 cm/s). For ED, RI, HR, and vessel diameter, no significant changes were observed. **Conclusion:** These preliminary findings suggest that CT may increase PS after short-term training, supporting a potential vascular mechanism, with future perspectives including an increased sample size.

Keywords

Breast Cancer; Exercise Training; Tumor Blood Flow; Doppler Ultrasound

Conflict of Interest & Ethical Approval

yes

Abstract submitters declaration

yes

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