

Effects of ankle exercise combined with deep breathing on blood flow velocity in the femoral vein. Kwon OY, Jung DY, Kim Y, Cho SH, Yi CH. Aust J Physiother. 2003;49(4):253-8.

Ankle exercises are commonly used to facilitate venous return in the lower extremity and to prevent deep vein thrombosis. Moreover, the respiratory cycle affects venous return. This study examined the effects of ankle exercise combined with deep breathing on the blood flow velocity in the femoral vein. Twenty healthy males (mean age 21.3 years), who had no medical history of lower extremity disease, were recruited for this study. The blood flow velocity in the femoral vein was measured while performing four exercise protocols: quiet breathing while resting (QR), deep breathing (DB), ankle exercise with quiet breathing (AQB), and ankle exercising combined with deep breathing (ADB). Using a Doppler ultrasound with an 8 MHz probe, peak blood flow velocities were collected for a 20 second period at the start of the inspiration phase in each protocol, three times. There were statistically significant differences in the peak blood flow velocity in the femoral vein with the four protocols ($p < 0.001$). The mean (SD) peak blood flow velocity in the femoral vein was as follows: QR 10.1 (4.2) cm/sec, DB 15.5 (3.9) cm/sec, AQB 20.7 (6.6) cm/sec, and ADB 26.5 (9.4) cm/sec. Post hoc analyses revealed significant differences between each of the four protocols ($p(\text{adj}) < 0.01$). The mean peak blood flow velocity in the femoral vein was greatest with the ADB protocol, which implies that the ADB protocol may be useful to prevent the blood stasis in patients at risk of deep vein thrombosis.