

Cardiovascular effects of physical activity and healthy lifestyle in patients with rheumatic and other chronic diseases

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The Applied Physiology & Nutrition Research Group is a research group from the University of São Paulo (USP), which conducts comprehensive clinical and experimental studies to uncover the role of physical activity and nutrition in sport, aging, obesity, and chronic diseases. The group is coordinated by Associate Professors Bruno Gualano and Hamilton Roschel and additional researchers and students with different scientific interests, from basic mechanistic physiology to applied clinical and sports research.

One of our group's primary research focus is to study the effects of physical activity and a healthy lifestyle on cardiovascular function in patients with rheumatic diseases, such as systemic lupus erythematosus, rheumatoid arthritis, juvenile idiopathic arthritis, and osteoarthritis. The group also conducts studies with patients undergoing and post-bariatric surgery, children and adolescents recovering from COVID-19 infection, athletes recovering from COVID-19 infection, and hospitalized patients currently infected with COVID-19.

For this purpose, two techniques, based on vascular ultrasound imaging, have been routinely used in the laboratory: (1) flow-mediated dilation (FMD), which is a non-invasive method to measure endothelial function in conduit arteries, and (2) assessment of carotid intima-media thickness (cIMT), which is a marker of pre-clinical atherosclerosis. Both measures have been shown to predict cardiovascular (CV) risk in multiple conditions and have been used in intervention studies to assess the effects of different treatments upon cardiovascular function and health.

Importantly, these techniques are operator-dependent and rely on accurate recording and analysis of vessel diameter, intima-media/media-adventitia interface, and blood flow velocity. These requirements can be satisfied by intensive training of sonographers, automatic edge detection, and wall-tracking software.

In our group, Dr. Tiago Peçanha has led the effort to train PhD students (Kamila Meireles, Sofia Sieczkowska, and Diego Rezende) to perform vascular measurements and to analyze both FMD and cIMT. As illustrated in the images below, PhD student Sofia Sieczkowska is assessing brachial artery diameter and blood flow velocity in a patient with systemic lupus erythematosus (Figure 1A); and PhD student Kamila Meireles is scanning the carotid artery from a patient with juvenile idiopathic arthritis (Figure 1B). Later, the analyses of both FMD and cIMT are performed offline using the Cardiovascular Suite (QUIPU). This software presents an automatic edge-detection and wall-tracking system and multiple features to calculate FMD, shear rate, cIMT, and carotid distensibility. This is a user-friendly software with an intuitive interface that allows students and researchers to become proficient more rapidly than other programs. As illustrated in Figure 2, Sofia Sieczkowska is performing an FMD analysis of one child with multisystem inflammatory syndrome post-COVID-19 using the Cardiovascular Suite. The use of this software has greatly improved the reproducibility of FMD and cIMT techniques across our research projects.

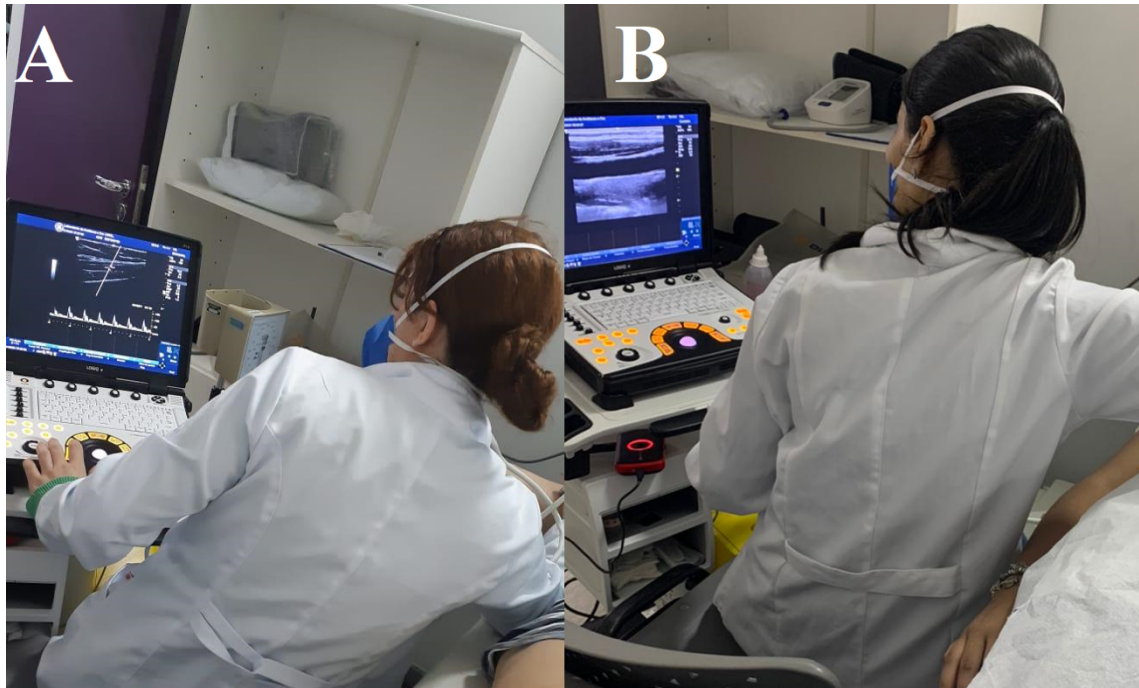


Figure 1.

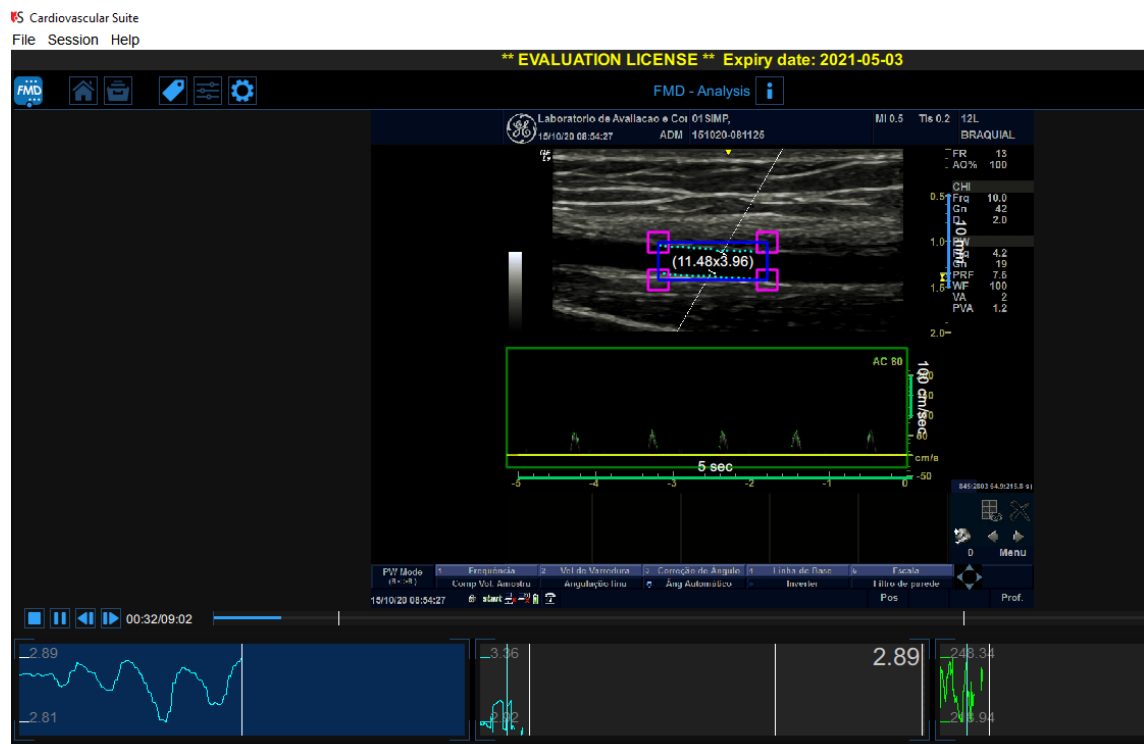


Figure 2.