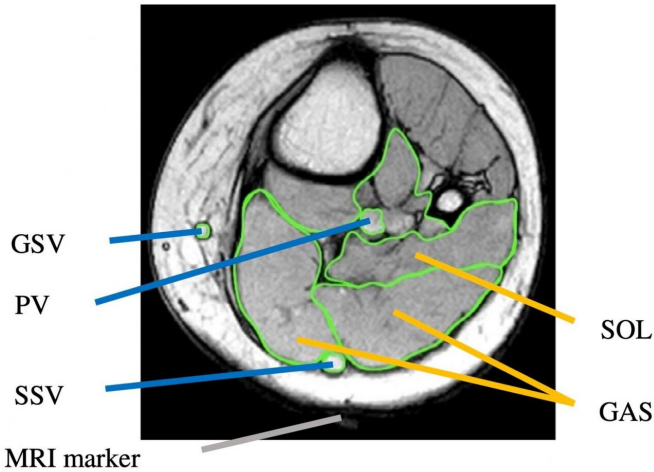


Leg muscle action assists blood flow independently of age

19 April 2021



T1WI with muscle and vein ROI set on the T1WI of the cross section at the center of the marker. Muscle area was measured for GAS and SOL. The vein area was measured for the PV and the GSV and SSV. PV, popliteal vein; GAS, gastrocnemius muscle; SOL, soleus muscle; GSV, great saphenous vein; SSV, small saphenous vein. Credit: Kanazawa University

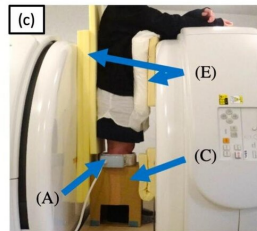
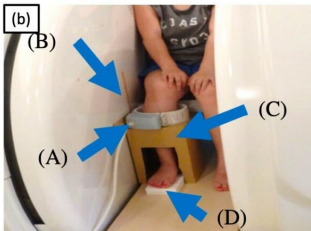
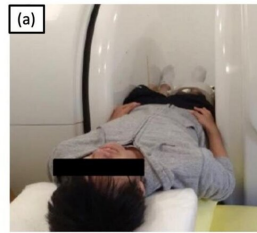
Chronic lower-limb edema (CLE)—the permanent accumulation of fluid in the leg—often occurs in elderly people. The condition leads to various physical and mental problems, including difficulty in walking or moving, fatigue and anxiety. One cause of CLE is the lack of physical activity, which is associated with a decrease in muscle pump action. The latter refers to the leg muscle's acting as a blood pump: when contracted, the muscle squeezes veins together, forcing blood to flow. The question whether muscle pump action systematically changes with age has not been thoroughly investigated; now, Junko Sugama from Kanazawa University and colleagues have addressed this issue. In addition, they studied how leg posture affects muscle pump action.

For their study, Sugama and colleagues recruited a

total of 76 healthy volunteers in three age categories: young, middle-aged and old, with average ages of 24, 47 and 72 years, respectively. They investigated blood flow in the subjects' lower legs by means of [magnetic resonance imaging](#) (MRI). The latter is a technique enabling visualizing the morphology of muscles and veins at a given position along the leg. The scientists made MRI cross-section images at 21 positions in the calf region; combining the images made it possible to obtain information on blood flow in the leg.

To examine the effect of leg motion, subjects were asked to perform plantar flexion (moving the foot so that it becomes aligned to the leg) every 2 seconds during one minute. MRI images were recorded before and after the exercise. The procedure was performed for three different body positions: supine (lying with face and torso facing upwards), sitting and standing.

The scientists found that for all postures, blood flow increased after the exercise, implying that the latter promotes [muscle pump](#) action. The [blood flow](#) velocity increased most for the standing posture (90-135%), followed by the supine (55-90%) and sitting (30-40%) postures. Generally, no difference in muscle pump action was found for the different age groups—but Sugama and colleagues point out that the majority of their elderly volunteers had exercise habits.



posture, *Japan Journal of Nursing Science* (2021).
[DOI: 10.1111/jjns.12407](https://doi.org/10.1111/jjns.12407)

Provided by Kanazawa University

(a) Supine posture. The non-measuring limb is placed beside the thigh with the knee joint bent. The hand is placed in a comfortable position for the subject. (b) Sitting posture. The leg and hands are placed in a comfortable position for the subject. The knee joint was adjusted to 105. (c) Standing posture. A cushion for trunk fixation (E) was used on the trunk to maintain posture. The hands were placed in a comfortable position for the subject. (A) Neck receiving coil. (B) Center of magnetic resonance image. (C) Height adjustment box. (D) Height adjustment plate. (E) Cushion for trunk fixation. Credit: Kanazawa University

The researchers suggest that measuring muscle pump action by nurses is useful for deciding whether intervention exercise is necessary to prevent CLE, but that MRI is not the most suitable tool for doing so—an easier device allowing measurement at the bedside would be required.

Although additional studies need to be done, for example adapting the measurement equipment so that it can be applied to elderly people with reduced walking ability, the scientists could conclude that for their set of subjects, "no difference was found in the changes in muscle pump action with age," and that "[elderly people](#) may be able to maintain their muscle pump action when they have exercise habits."

More information: Taiga Fujii et al, Gravity magnetic resonance imaging measurement of muscle pump change accompanied by aging and

APA citation: Leg muscle action assists blood flow independently of age (2021, April 19) retrieved 23 April 2021 from <https://medicalxpress.com/news/2021-04-leg-muscle-action-blood-independently.html>

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