Exercise induces secretion of biomarkers into sweat

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In the future sweat may be used as a biomarker source for exercise monitoring. Credit: Pixabay, Linus Schütz

A new study shows that in addition to blood, endurance exercise induces changes in sweat biomolecule levels. These findings lay the groundwork for the development of future noninvasive exercise monitoring systems that utilize sweat as a biomarker source.

Sweating is an important part of thermoregulation during exercise, yet the potential for sweat as a biomarker source has not been established. Currently, the key limiting steps of using sweat as a biomarker source

for exercise monitoring are the low abundance of biomarkers and variation in the volume of sweat in different environments and in different persons.

"Previously, sweat has been utilized in the diagnostics of certain diseases, such as cystic fibrosis. In addition, several drugs are secreted into sweat, enabling detection of the drug from sweat instead of blood," explains postdoctoral researcherSira Karvinenfrom the Gerontology Research Center and Faculty of Sport and Health Sciences, University of Jyväskylä, Finland.

New finding: Extracellular vesicles in sweat contain microRNAs

Evaporation of sweat from the skin surface lowers body temperature preventing overheating of the body in hot environments as well as during strenuous exercise. Although sweat is a natural by-product of exercise and has been studied for several decades, a role for it as a biomarker source in the field of exercise has not been established.

It has previously been observed that similarly as blood and other body fluids, sweat contains extracellular vesicles. Extracellular vesicles are composed of a lipid bilayer and a core containing transported signal molecules, which cells release to facilitate communication between cells and tissues. A novel finding of the current study was that sweat extracellular vesicles contain microRNA molecules. MicroRNAs regulate several biological processes and have been identified as essential mediators in exercise adaptations. Previously, endurance exercise has shown to change the level of several microRNAs in blood.

"In our study we examined how elevation in body temperature induced by sauna and endurance exercise protocols affect the abundance of

microRNAs in sweat and serum extracellular vesicles. Endurance exercise protocols were carried out with a bicycle ergometer," says Urho Kujala, Professor of sports and exercise medicine, from the Faculty of Sport and Health Sciences, University of Jyväskylä, Finland. "Our aim was to reveal the potential of microRNAs in sweat extracellular vesicles in monitoring exercise performance."

In the present study sweat samples were harvested from the study subjects during sauna bathing and during three different endurance exercise tests: a maximal aerobic capacity test and high and low intensity endurance exercise tests. Sweat was collected during the entire duration of each test from both arms and blood samples were taken before and after each test.

Sweat may be used as a biomarker source for exercise monitoring in the future

The present study showed that the abundance of certain microRNAs changed in response to exercise of different intensity in sweat extracellular vesicles. In particular, the high-intensity endurance exercise test induced an increase in the studied microRNAs in serum and sweat.

"Our study is the first to show that sweat possesses unique miR carrier content that is different from that observed in blood," Karvinen explains. "This may partly explain the observation that sweat and serum microRNA levels are not similar."

Based on the results of the present study, sweat has a potential to serve as a biomarker source for future exercise monitoring systems. However, sweat possesses a unique miR carrier content that should be taken into account when planning analyses from sweat as a substitute for serum. There are currently no commercially available sweat-based monitoring

systems, as first there is a need to invent new technologies to robustly detect very small amounts of biomarkers.

More information: Sira Karvinen et al. MicroRNAs in Extracellular Vesicles in Sweat Change in Response to Endurance Exercise, *Frontiers in Physiology* (2020). DOI: 10.3389/fphys.2020.00676