Sweat it out: Study examines ability of sweat patches to monitor bone loss

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Some health assessments that are routinely carried out on Earth are not practical when the "patients" are free-floating astronauts on long space flights, such as missions to Mars or the Moon. A new, NASA-funded study from the University of Houston department of health and human performance will examine how well sweat patches the size of adhesive strips can detect levels of chemicals that may indicate bone loss.

"Current assessments involve blood tests, urine analysis or bone density scans, all of which are time-consuming, inconvenient to the working astronauts or, in the case of bone density scans, require large equipment that's not practical on a space station," said Mark Clarke, associate professor and principal investigator. "These patches are small, non-intrusive, and placed on the skin to collect a sweat sample. The sample is then analyzed for biomarkers of bone loss markers, such as calcium."

The three-year, $780,000 study will examine three types of sweat patches, each differing in the way the sweat is collected and extracted from the devices. One device collects the sweat between the skin and a plastic layer; another is a commercially used patch that absorbs the sweat and is then reconstituted with water. The third is called a Microfabricated Sweat Patch (MSP) built using micro-chip inspired-technology. Sweat is removed from the MSP using a mini-centrifuge. The technology was developed by Clarke and Daniel Feeback, a lead scientist with NASA's Life Science Directorate.

"Our goal is to develop a micro-fabricated sweat patch that collects a

sweat sample from the skin, performs a biomarker analysis and immediately provides a read-out to the user," said Clarke. The first phase of the study will determine if sweat can be used to monitor bone loss. Next, it will determine which patch technology most accurately measures the chemicals associated with bone loss.

The last phase of the study will look specifically at the MSP and will involve 60 people, from young college students to elderly men and women, to new Air Force recruits. Each will wear a series of patches during normal daily activities and then perform exercises at the UH Laboratory of Integrated Physiology. The patches then will be collected and the sweat analyzed. Changes in bone also will be monitored using bone mineral density scans performed in the department. Clarke expects this phase of the project to span at least eight months.

Being in a microgravity environment causes astronauts' bodies to lose more bone mineral than they can replace, which makes them vulnerable to fractures and breaks. Even when they return to Earth, the bone loss continues as their bodies slowly begin the process of replacing the bone mineral content. This is a critical concern, especially as the space program considers longer space missions to Mars or the Moon.

Clarke says the research has applications for those susceptible to bone loss, such as the elderly, post-menopausal women and adolescent girls

"Typically, it takes up to six months to see if changes in your exercise and eating habits are helping to maintain or increase bone mineral density," Clarke said. "Astronauts on long flights need this information quicker so that they can make adjustments to their exercise protocols, diet or drug treatments. Similarly, bone loss in women can be seen as early as the teen years, so this kind of fast and easy screening device can provide advance notice to fend off serious bone density issues later in their lives."

Data will be presented at annual NASA conferences.

Source: University of Houston