Exercise may have different effects in the morning and evening

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Researchers from the University of Copenhagen have learned that the effect of exercise may differ depending on the time of day it is performed. In mice, they demonstrate that exercise in the morning

results in an increased metabolic response in skeletal muscle, while exercise later in the day increases energy expenditure for an extended period of time.

We probably all know how important a healthy circadian rhythm is. Too little sleep can have severe health consequences. But researchers are still making new discoveries confirming that the body's circadian clock affects our health.

Now, researchers from University of Copenhagen—in collaboration with researchers from University of California, Irvine—have learned that the effect of exercise may differ depending on the time of day it is performed. Studies in mice reveal that the effect of exercise performed in the beginning of their dark/active phase, corresponding to morning, differs from the effect of exercise performed in the beginning of the light/resting phase, corresponding to evening.

"There appear to be rather significant differences between the effect of exercise performed in the morning and evening, and these differences are probably controlled by the body's circadian clock. Morning exercise initiates gene programs in the muscle cells, making them more effective and better capable of metabolizing sugar and fat. Evening exercise, on the other hand, increases whole body energy expenditure for an extended period of time," says one of the researchers behind the study, Associate Professor Jonas Thue Treebak from the Novo Nordisk Foundation Center for Basic Metabolic Research.

Morning exercise is not necessarily better than evening exercise

The researchers measured a number of effects in the muscle cells, including the transcriptional response and effects on the metabolites. The results show that responses are far stronger in both areas following exercise in the morning and that this is likely to be controlled by a

central mechanism involving the protein HIF1-alfa, which directly regulates the body's circadian clock.

Morning exercise appears to increase the ability of muscle cells to metabolize sugar and fat, and this type of effect interests the researchers in relation to people with severe overweight and type 2 diabetes.

On the other hand, the results also show that exercise in the evening increases energy expenditure in the hours after exercise. Therefore, the researchers cannot necessarily conclude that exercise in the morning is better than exercise in the evening, Jonas Thue Treebak stresses.

"On this basis we cannot say for certain which is best, exercise in the morning or exercise in the evening. At this point, we can only conclude that the effects of the two appear to differ, and we certainly have to do more work to determine the potential mechanisms for the beneficial effects of exercise training performed at these two time-points. We are eager to extend these studies to humans to identify if timed exercise can be used as a treatment strategy for people with metabolic diseases," he explains.

The article behind the new research results will be published in the next issue of *Cell Metabolism*.

More information: Shogo Sato et al, Time of Exercise Specifies the Impact on Muscle Metabolic Pathways and Systemic Energy Homeostasis, *Cell Metabolism* (2019). DOI: 10.1016/j.cmet.2019.03.013

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