Become a marathon runner with the protein PGC-1alpha

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The protein PGC-1? is associated with high endurance muscles. (Image: KJohansson / wikipedia)

Even with a greater muscle mass, a sprinter cannot win a marathon. His specially-trained and strengthened muscles will fatigue faster than the endurance-trained muscles of a long distance runner. The research group of Prof. Christoph Handschin of the Biozentrum, University of Basel, shows that during endurance exercise the protein PGC-1? shifts the metabolic profile in the muscle. The results are published in the current issue of the journal *PNAS*.

Marathon runners complete a special training program to improve their endurance capacity. Accordingly, their muscles are able to sustain the provision of energy using aerobic, hence oxygen consuming processes. Untrained athletes and also bodybuilders reach however, in a much earlier stage, a condition where their muscles produce energy without oxygen. This results in the production of lactate in the muscles. At the same time, the muscles begin to fatigue and the legs become heavy.

Less lactate with endurance training

The reason for this difference: the muscles switch their metabolism during endurance training. Importantly, amongst others, the production of the protein PGC-1? is stimulated. Mice with a permanently increased PGC-1? develop the same high endurance muscles as those in trained athletes. Handschin and his team were able to show in these mice that PGC-1? prevents the formation and accumulation of lactate in the muscles. For this, the researchers trained the mice for an hour on the treadmill. After a few minutes, the lactic acid rates increased in the untrained mice, followed by performance degradation and exhaustion. Mice with a high PGC-1?, however, maintained their performance levels until the end of the training. Their lactate levels remained low despite a high training load. "As it turned out," said Handschin, "PGC-1? changed the composition of an enzyme complex. This reduced the formation of lactate. Also, the remaining lactate in the muscle is converted and used immediately as energy substrate."

Sport therapy for diabetics

Also in human skeletal muscle, PGC-1? controls the balance between the formation and degradation of lactate. Disturbances in lactate metabolism are common in obese and diabetic patients. The stimulation of PGC-1? production by endurance exercise activity is therefore an important approach to improve the metabolism in these patients. This could help prevent the resulting damage and progressive physical limitations to the body caused by metabolic diseases.

More information: Summermatter, S. et al. Skeletal muscle PGC-1? controls whole-body lactate homeostasis through estrogen-related receptor ?-dependent activation of LDH B and repression of LDH A. *Proceedings of the National Academy of Sciences* (PNAS), Published online May 6, 2013. www.pnas.org/content/early/201 … /1212976110.abstract

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