

Enzymic and metabolic adaptations in the gastrocnemius, plantaris and soleus muscles of hypocaloric rats.

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Abstract

1. The effect of hypocaloric feeding (25% of normal food intake for 21 days) of rats on the enzymic and metabolic adaptations in the gastrocnemius, plantaris and soleus muscles was studied. 2. In control and hypocaloric rats the muscle relaxation rates at 100 Hz were 35.76 and 11.38% force loss/10 ms respectively. Control rats exhibited enhanced force of muscle contraction as the frequency of stimulation increased from 10 to 100 Hz, with maximum force being at 100 Hz. Hypocaloric rats exhibited a decrease in the increment of force being exerted at high frequencies, with maintenance of force at lower stimulatory frequencies. 3. In muscles of hypocaloric rats, there were significant decreases in the maximal activities of hexokinase (17.6-37.0%), 6-phosphofructokinase (22.7-34.2%), pyruvate kinase (21.2-36.0%), citrate synthase (34.1-41.5%), oxoglutarate dehydrogenase (29.4-52.4%) and 3-hydroxyacyl-CoA dehydrogenase (26.7-32.1%), whereas the activities of glycogen phosphorylase increased (23.8-43.4%) compared with control values. 4. In soleus-muscle strip preparations of hypocaloric rats, there were significant decreases in the rates of lactate production (28.1%) and glucose oxidation (32.6%) compared with control preparations. 5. Mitochondrial preparations from muscles of hypocaloric rats incubated with various substrates exhibited decreased rates of oxygen uptake compared with control preparations. 6. In muscles of hypocaloric rats (gastrocnemius and soleus), there were significant decreases in the concentrations of glycogen (P less than 0.001) and phosphocreatine (P less than 0.001) and increases in those of pyruvate (P less than 0.001), lactate (P less than 0.001) and ADP (P less than 0.001), whereas those of ATP and AMP remained unchanged. 7. Calculated [lactate]/[pyruvate] and [ATP]/[ADP] ratios exhibited significant increases (P less than 0.05) and decreases (P less than 0.05) in muscles of hypocaloric rats respectively. 8. The results are discussed in relation to the genesis of muscle dysfunction caused by malnutrition

