Abstract

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Physical and mental fatigue: metabolic mechanisms and importance of plasma amino acids.

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BACKGROUND: There are at least 5 metabolic causes of fatigue, a decrease in the phosphocreatine level in muscle, proton accumulation in muscle, depletion of the glycogen store in muscle, hypoglycaemia and an increase in the plasma concentration ratio of free tryptophan/branched-chain amino acids. Proton accumulation may be a common cause of fatigue in most forms of exercise and may be an important factor in fatigue in those persons who are chronically physically inactive and also in the elderly: thus, the aerobic capacity markedly decreases under these conditions, so that ATP must be synthesized by the much less efficient anaerobic system.

DISCUSSION: A marked increase in the plasma fatty acid level, which may occur when liver glycogen store is depleted and when hypoglycaemia results, or during intermittent exercise when the rate of fatty acid oxidation may not match the mobilisation of fatty acids, could be involved indirectly in fatigue. This is because such an increase in the plasma level of fatty acids raises the free plasma concentration of tryptophan, which can increase the entry of tryptophan into the brain, which will increase the brain level of 5-hydroxytryptamine: there is evidence that the latter may be involved in central fatigue.

CONCLUSION: In this case, provision of branched-chain amino acids in order to maintain the resting plasma concentration ratio of free tryptophan/branched-chain amino acids should delay fatigue--there is prima facie evidence in support of this hypothesis. This hypothesis may have considerable clinical importance.

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