

[Biochem J.](#) 1982 Dec 15;208(3):743-8.

Maximum activities of some enzymes of glycolysis, the tricarboxylic acid cycle and ketone-body and glutamine utilization pathways in lymphocytes of the rat.

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Abstract

1. The maximum activity of hexokinase in lymphocytes is similar to that of 6-phosphofructokinase, but considerably greater than that of phosphorylase, suggesting that glucose rather than glycogen is the major carbohydrate fuel for these cells. Starvation increased slightly the activities of some of the glycolytic enzymes. A local immunological challenge in vivo (a graft-versus-host reaction) increased the activities of hexokinase, 6-phosphofructokinase, pyruvate kinase and lactate dehydrogenase, confirming the importance of the glycolytic pathway in cell division. 2. The activities of the ketone-body-utilizing enzymes were lower than those of hexokinase or 6-phosphofructokinase, unlike in muscle and brain, and were not affected by starvation. It is suggested that the ketone bodies will not provide a quantitatively important alternative fuel to glucose in lymphocytes. 3. Of the enzymes of the tricarboxylic acid cycle whose activities were measured, that of oxoglutarate dehydrogenase was the lowest, yet its activity (about 4.0 $\mu\text{mol}/\text{min}$ per g dry wt. at 37 degrees C) was considerably greater than the flux through the cycle (0.5 $\mu\text{mol}/\text{min}$ per g calculated from oxygen consumption by incubated lymphocytes). The activity was decreased by starvation, but that of citrate synthase was increased by the local immunological challenge in vivo. It is suggested that the rate of the cycle would increase towards the capacity indicated by oxoglutarate dehydrogenase in proliferating lymphocytes. 4. Enzymes possibly involved in the pathway of glutamine oxidation were measured in lymphocytes, which suggests that an aminotransferase reaction(s) (probably aspartate aminotransferase) is important in the conversion of glutamate into oxoglutarate rather than glutamate dehydrogenase, and that the maximum activity of glutaminase is markedly in excess of the rate of glutamine utilization by incubated lymphocytes. The activity of glutaminase is increased by both starvation and the local immunological challenge in vivo. This last finding suggests that metabolism of glutamine via glutaminase is important in proliferating lymphocytes