The role of ribose in human skeletal muscle metabolism

ABSTRACT

Bioenergetic pathways in muscle provide high-energy compounds that are required for cellular integrity and function. Increased cellular demand for adenosine triphosphate (ATP) or limitations in the rephosphorylation rate of adenosine diphosphate (ADP) can decrease the total adenine nucleotide (TAN) pool, which may take several days to recover or may not recover at all in cases of chronic ischemia. Total adenine nucleotide levels may be significantly decreased as a result of myocardial or skeletal muscle ischemia, certain metabolic diseases, repeated intense skeletal muscle contractions or in repetitive high-intensity exercise. Ribose, a naturally occurring pentose sugar, has been shown to enhance the recovery of myocardial or skeletal muscle ATP and TAN levels following ischemia or high-intensity exercise. Furthermore, ribose has been demonstrated to modulate the production of oxygen free radicals during and following exercise. The following paper reviews skeletal muscle energetics and the potential role of ribose during and following exercise.

CONCLUSION

When oxidative phosphorylation is limited in skeletal muscle due to disease state or exercise, turnover rates of ATP are jeopardized and TAN pools are decreased. Metabolic pathways, such as the purine nucleotide pathway and the pentose phosphate pathway, needed to replenish these pools are active but rate limited. The reduced levels of adenine nucleotides may not recover for days, oxygen free radical products may be elevated for a considerable time period and performance ay potentially be reduced. The combination of these metabolic effects may affect cell integrity and function. Exogenous ribose increases cellular levels of R-5-P, bypasses the rate-limiting enzymatics steps in the PPP to from PRPP and ultimately improves adenine nucleotide synthesis and salvage. Supplementation of ribose offers a potential benefit in energy metabolism by attenuating the loss and/or enhancing the recovery of TANs and modifying oxygen free radical production. This protective and enhancing benefit may have significant implications in maintaining cellular integrity, modulating function of key cellular mechanisms and positively altering exercise performance.