Determination of the tolerable upper intake level of leucine in adult men.

Pencharz PB, Elango R, Ball RO.

Source

The Research Institute, The Hospital for Sick Children, Toronto, ON, Canada. paul.pencharz@sickkids.ca

Abstract

Leucine is purported to improve athletic performance. Therefore, the BCAA, especially leucine, are popular as dietary supplements among strength-training athletes. There are, however, concerns regarding possible adverse effects of excessive leucine intake. The objective of the current study was to determine the metabolic and adverse effects of the acute ingestion of very high intakes of leucine supplements. Five healthy men (20-35 y) each received graded stepwise increases in leucine intakes of 50, 150, 250, 500, 750, 1000, and 1250 mg · kg(-1) · d(-1) corresponding to the Estimated Average Requirement, and Estimated Average Requirement ×3, ×5, ×10, ×15, ×20, and ×25 to a total of 29 studies. The graded stepwise approach was used rather than a randomization of leucine intake to minimize the possibility of severe adverse effects. Participants were given a maintenance diet for 2 d prior to each leucine level containing 1 g · kg(-1) · d(-1) of protein and 1.7× measured the resting metabolic rate. Leucine oxidation was determined using L-[1-13C]-leucine and the appearance of (13)CO(2) (calculated as F(13)CO(2)) in breath. A range of markers was used to monitor for adverse effects, including glucose, insulin, alanine aminotransferase, and ammonia. Plasma leucine concentrations significantly increased beyond an intake of 500 mg · kg(-1) · d(-1). The metabolic limit to oxidize leucine was between 550 and 700 mg · kg(-1) · d(-1). An increase in blood ammonia concentrations was observed at leucine intakes >500 mg · kg(-1) · d(-1). There were no changes in liver alanine aminotransferase. Glucose concentrations fell (P < 0.004) but remained within the normal range and without any change in insulin. This study is the first to our knowledge to directly estimate the safe upper limit of leucine intake in humans and raises concerns that intakes >550 mg · kg(-1) · d(-1) or ~39 g/d may be a risk to health. It is important to note that these are acute studies, where each participant was exposed to graded increases in leucine intake. Longer term adaptation was not studied.