Does supplementation of β-hydroxy-β-methylbutyrate increase muscle mass in rats?

Ed Rosic
Faculty Mentor:
Debra Pearce, PhD
Department of Biological Sciences
Northern Kentucky University
Highland Heights, KY 41099

Abstract

β-hydroxy-β-methylbutyrate (HMB), a leucine metabolite, purportedly has positive effects on gain in strength and size of muscle cells and a positive effect on lowering plasma cholesterol levels. HMB is being sold over the counter as a dietary supplement and therefore is not regulated by the FDA. The objective of this experiment was to determine the safety and effectiveness of HMB using rats as an animal model. The data were obtained for a period of 35 days from 9 rats/group and included total body weight, weight of their gastrocnemius muscle, and total plasma cholesterol levels. The rats were male, weighing 175-199 g at the outset of the experiment. The rats were then divided into three groups. One group received 8.7 mg of HMB twice a day (manufacturer’s recommended dose for humans, adjusted to rat weight); the second group received three times the amount of the first group (26.1 mg); and the last group received a dose of water. The rats were allowed Purina Rat chow and water ad libitum. The weights were measured every week, starting on day 1 and ending on day 35 of the experiment. The data analyzed via ANOVA show that there were no significant differences among the three groups in total body weight, gastrocnemius weights, or total plasma cholesterol levels. Hence, HMB did not have a significant effect on the parameters measured.

Introduction

Due to the 1994 Dietary Supplement Health and Education Act, manufacturers of products currently not classified as drugs, but labeled as food supplements, do not have to prove safety or effectiveness prior to being marketed. Little scientific literature exists to support the claims of efficacy or to prove the safety of these products. One such product, β-hydroxy-β-methylbutyrate (HMB), a branched-chain amino acid, is being sold over the counter as a food supplement to promote muscle mass gain. HMB is a catabolite of the amino acid leucine. Leucine is metabolized in the liver via transamination into α-ketoisocaprate (KIC). Deoxygenases convert KIC into HMB in the cytosol (Sabourin and Bieber 1983). Approximately 5% of leucine in the body is converted into HMB via this mechanism, producing approximately 0.3 g of HMB per day in a 70 kg individual (Nissen et al 1996). Some studies (Nissen et al 1996, 2000) have indicated that HMB plays an important role in maintaining cellular levels of proteins during strenuous exercise or postsurgical trauma. During HMB supplementation, the rate of degradation of proteins is purportedly significantly reduced; however, the mechanism is still unknown (Nissen et al 1996). HMB, a precursor to cholesterol via β-hydroxy-β-methylglutarate CoA (HMG-CoA), may help prevent cellular damage and hence proteolysis by promoting the synthesis of cholesterol to help maintain the structural integrity of cell membranes (Nissen 2000).

Materials and Methods

The experiment was performed for a period of 4 weeks on three rat groups: two experimental and one control group, with nine rats per group. The gastrocnemius muscle weight differences, and the plasma cholesterol levels were measured for each of the groups.

The first group received 8.7 mg of HMB dissolved in 0.1 ml of water. The second group received three times as much as the first group (26.1 mg). The control group received only water. The groups were dosed via feeding needle twice a day, every day.
Figure 1. Weight differences (in gm) of rats (a) and gastrocnemius muscles (b). Rats were fed 8.7 mg of HMB (1xHMB) and 26.1 mg HMB (3xHMB). The percent change in muscle weight is shown in (c).
The rats were male, with initial weights between 175-199 g and were given Purina Rat chow and water *ad libitum*.

All of the rats were housed individually in 15 × 25 in. cages. Rat weights were measured every Monday, starting on day 1 and ending on day 35. Plasma cholesterol levels were measured along with the weights of the right gastrocnemius muscle on the last day of the experiment.

**Results**

Review of the data gathered over the course of the experiment (Figure 1) revealed that there were no significant differences in gastrocnemius and total body weights among the three groups (P=0.4609, P=0.4058). The total plasma cholesterol levels among the three groups did not differ (P = 0.1859).

**Conclusion**

The data revealed that there were no significant differences among the three groups of rats in total body weight, gastrocnemius weights, and total plasma cholesterol levels. If these data can be extrapolated to humans, the data do not support the manufacturer’s claims regarding the product’s anabolic benefits.

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**References**


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