The regulation of glucose and fat metabolism by beta-hydroxybutyrate (BHB) in skeletal muscle cells

Ketogenic diets have been around for decades as a successful treatment for epilepsy. More recently, these diets have become popular because of their effectiveness at treating conditions such as obesity and type 2 diabetes. Ketogenic diets are low in carbohydrates and high in fat contents leading to the production of ketones, primarily beta-hydroxybutyrate (BHB). It has been proposed that the beneficial metabolic effects of ketogenic diets can be mimicked by oral supplementation of BHB, without having to restrict dietary carbohydrate intake. This could have therapeutic value for obesity and its related metabolic disorders. Because BHB can be used a fuel and also exert signaling properties in various organs and tissues, it is possible that it could enhance whole-body glycemic control. However, the metabolic effects of BHB and the potential molecular mechanisms by which it may affect major tissues that consume glucose in the body remain speculative. In this context, it has been hypothesized that the improvements in glycemic control obtained with ketogenic diets could be mediated by direct effects of BHB on skeletal muscle cells. Skeletal muscle is important because it accounts for ~40% and ~30% of total body mass in men and women, respectively. It is also the main site of insulin-stimulated glucose uptake in the body, which makes it a potential tissue that could be affected by BHB. In order to test this hypothesis, skeletal muscle cells were treated in time- and concentration-dependent manner with BHB. Subsequently, several parameters of glucose uptake and metabolism were assessed in these cells. Our preliminary finding suggest that BHB can enhance glucose uptake and its metabolism in skeletal muscle cells and mimic some of the beneficial effects of ketogenic diets on glycemic control.