Effects of Carbohydrate, Starch, Protein, and Fiber on Levels of Ghrelin in the Body

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Abstract

Ghrelin (Ghr) is a secreted hormone, the levels of which increase during times of low nutrient availability to regulate the sensation of hunger. Understanding the effects that certain macromolecules (protein, fiber, starch, and carbohydrates) have on the secretion of Ghr can play an important role in maintaining a healthy diet and body weight. A Ghr-specific ELISA test was carried out on the blood samples of 16 subjects to determine the effect that specific macromolecules play on the suppression of Ghr. The test demonstrated no significant difference in the change of Ghr levels before and after the intake of the tested macromolecules.

Keywords: Ghrelin, macromolecules, suppression, ELISA, diet.

Introduction

Ghrelin is an octanoylated 28 amino acid gastric hormone that is involved in the regulation of appetite (Inui et al. 2004). Ghr is secreted into the bloodstream by the cells that line the fundus of the stomach and by epsilon cells of the pancreas (Tesauro et al. 2010) at times of low nutrient availability to promote food intake and to serve as a fuel storage gauge (Scott et al. 2012). This hormone was originally discovered as a ligand of the growth hormone secretagogue receptor (GHS-R) (Jakubke and Sewald 2009, Zhao et al. 2010a). It can also serve as a powerful stimulant of growth hormone release, food intake, adiposity, and as a potent regulator of energy homeostasis (Helmling et al. 2004, Tesauro et al. 2010).

Plasma Ghr concentrations rise dramatically before meals and decline immediately after eating (Zhao et al. 2010a & b). Concentrations also vary in response to different types of food (Scott et al. 2012). Despite widespread use of various macronutrient-focused diets, a full understanding of how different diets affect the levels of Ghrelin in the body has not been observed (Foster-Schubert et al 2008) and data has not been resolved (Wang et al. 2007). Most studies simply monitor the levels of acyl-ghrelin, the most commonly used Ghr measurement (Foster-Schubert et al. 2008), in response to food intake, overall, without regard to specific macronutrients. The effect of specific macronutrient classes on
Ghr levels has yet to be fully examined. The purpose of this study was to measure the change in Ghr concentration in response to consumption of specific macronutrient classes in humans.

Methods

Eight males and eight females ranging in age from 19-30 years were recruited for this study. The test protocol was approved by the Brigham Young University-Hawaii Institutional Review Board. Each participant was instructed to fast 12 hours prior to the morning of the study. Blood samples were collected right before and 30 minutes after intake of a specific single ingredient food preparation (starch, lipid, protein, or fiber). The starch consisted of 14 g cornstarch suspended in 8-10 ml water. The lipid was prepared by mixing 28 g olive oil in 8-10 ml water. The protein preparation consisted of 14.4 g cooked egg white. The fiber slurry consisted of 15 g unsweetened Metamucil in 8-10 ml water. Four participants were tested on each of the four-macronutrient preparations.

Blood was drawn directly into Vacutainer® serum tubes that contained no anti-coagulant. Pefabloc was immediately added to a final concentration of 1 mg/mL and samples were incubated at room temperature for 30 minutes. Samples were centrifuged (2,000 rpm, 15 minutes, 4°C), the clarified serum was transferred to clean tubes, and HCl was added to a final concentration of 0.05 M. Ghrelin concentration was then measured using the Millipore Human Ghrelin (Active) ELISA kit (Cat. #2EZGRA-88K). The absorbance at 450 nm and 590nm was determined in a plate reader five minutes after adding the stop solution and was compared with a standard curve to estimate Ghr concentrations. Replicates were averaged, and a repeated measures ANOVA test was used to determine significance.

Results

Differences in Ghrelin concentration, determined by comparing blood serum concentration before and after the consumption of specific macronutrients, were determined for each participant and
measured by ELISA assay (Table 1). No significant differences were observed in Ghrelin levels before and after the intake of any of the tested macromolecules.

Table 1 Aver age differences in Ghrelin concentrations before and after intake of each macromolecule.

<table>
<thead>
<tr>
<th>Subjects (n)</th>
<th>Protein</th>
<th>Lipid</th>
<th>Carbohydrate</th>
<th>Fiber</th>
</tr>
</thead>
<tbody>
<tr>
<td>n=4</td>
<td>n=4</td>
<td>n=4</td>
<td>n=4</td>
<td>n=4</td>
</tr>
<tr>
<td>Ghr Concentration Differences (initial – final), pg/ml</td>
<td>-22.4±151 NS</td>
<td>97.5±145 NS</td>
<td>91.2±190 NS</td>
<td>-53.1±69.2 NS</td>
</tr>
</tbody>
</table>

NS non-significant

Discussion

The intake of different foods, including bread, meat, and rice, has been shown to suppress Ghr production to varying extents (Foster-Schubert et al. 2008, Scott et al. 2012). However, the extent to which specific macromolecules suppress Ghr is still not well understood (Foster-Schubert et al. 2008). While this study failed to demonstrate the ability of a specific macronutrient to suppress acyl-Ghrelin in blood serum as assayed, higher caloric or volumetric quantities of these single nutrient preparations may yet indicate the specific characteristics of foods that work to suppress Ghr concentrations (Foster-Schubert et al. 2008). An understanding of the characteristics of foods that suppress Ghr secretion can play an important role in maintaining a healthy diet and body weight. The investigation at hand did not show that any particular macromolecule (lipid, protein, starch, or fiber) played a significant role in helping with a certain diet, but further studies could be examined to help figure out the suppression of Ghr.
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References:


