The Effect of Ghrelin on Memory Acquisition

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Introduction

Ghrelin (Ghr) is an octanoylated 28 amino acid gastric hormone (Zhao et al. 2010a). Ghr is secreted by the cells that line the fundus of the stomach and epsilon cells of the pancreas into the bloodstream (Tesauro et al. 2010). Ghr is a powerful stimulant of growth hormone release, food intake, adiposity, and is involved in the regulation of energy homeostasis (Tesauro et al. 2010). Plasma Ghr concentrations rise dramatically before meals and decline immediately after eating (Zhao et al. 2010a &b).

Diano et al. (2006) demonstrated that circulating exogenous ghrelin enhanced dendritic spine synapse generation and formation in mice. These Ghr-induced synaptic changes had direct correlation with improved spatial learning and memory (Carlini et al. 2010, Diano et al. 2006, Zhao et al. 2010b).

Carlini et al. (2010) found exogenous Ghr increased in long-term memory retention in mice and rats. Carlini et al. (2010) concluded Ghr may be influential in memory acquisition but not in retrieval.

The effects of Ghr and memory correlation in humans have yet to be investigated. The purpose of this study was to test the effects of endogenic ghrelin adult human males.

Materials and Methods

• Fourteen males (age ranges of 20-25) were recruited for the study.
• Subjects were divided into two groups—fasting and non-fasting.
• The fasting group underwent an overnight fast before the acquisition portion.
• Blood samples were taken from each group and analyzed via an ELISA Assay (Millipore Human Ghrelin Active ELISA kit) for Ghr levels.
• Each participant was presented with a list of 15 negative words and 15 words with a neutral connotation. Subjects studied the list for 15 minutes.
• Twenty four hours later, subjects were asked to recall as many words as possible.
• Differences in word recall and group type were analyzed by a paired t-test.

Results: Plasma Ghr Levels

- Ghr levels in fasting group: Mean 161.2 pg/mL (±84.4 SD).
- Ghr levels in non-fasting group: Mean 60.9 pg/mL (±18.0 SD).
- A paired t-test revealed that the fasting group had significantly higher amounts of serum Ghr levels (p-value 0.012) than the non-fasting group.

Figure 1. The mean (± SD) concentration of Ghr levels in the blood for fasting and non-fasting groups. *p<0.05.

Results: Memory

- Word acquisition and recall test in fasting group: Mean 23.38 words (±8.03 SD)
- Word acquisition and recall test in the non-fasting group: Mean 25.67 words (±4.03 SD).
- A paired t-test indicated that there was no statistical significance (p-value 0.501) between the two groups.

Figure 2. The mean (± SD) number of words recalled after 24 hours, for fasting and non-fasting groups.

Discussion

Zhao et al. (2010b) showed that plasma Ghr concentrations increased before meals and declined immediately after eating. The results of this study also found elevated levels of Ghr in fasting individuals compared to their non-fasting counterparts.

Previous studies have shown that administration of exogenous Ghr increased long-term memory retention in mice and rats (Carlini et al. 2010). This study, the first to investigate the relationship between the interactions of Ghr and memory/retrieval, could not confirm that there was a significant increase in long-term or short-term memory retention. Carlini et al. (2010) postulated that Ghr may be influential in memory acquisition but not in retrieval in mice. This found no differences in acquisition or retrieval with increased Ghr in humans.

Future research on the administration of exogenous Ghr in humans, in relation to memory acquisition and recall, may yield different results with different protocols.

However, due to the lack of research in human subjects, the results of this study stand as a valuable baseline of the exploration of memory and hunger. As far as this study could conclude, there was no relation between endogenic Ghr and memory acquisition or retrieval.

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References