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Brain response to fat could determine future path in tackling obesity, study says

By Will Chu, 26-Sep-2016

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Consuming a meal high in fat appears to reduce the brain reward response — a finding that has future implications in the reformulation of low-fat foods and the fight against obesity.

Researchers from the University of Nottingham found that eating foods high in fat increased the gut peptide cholecystokinin (CCK), a hormone responsible for stimulating fat and protein digestion.

They found this increase in CCK concentration controlled the blood oxygenation level–dependent (BOLD) signal in certain brain regions associated with reward and satiation.

The findings add further understanding of current mechanisms involving oral fat satiation. If foods can be reformulated to mimic the brain's response to high-fat counterparts, an intervention to tackle obesity may well become viable.

Study details

The study asked 17 healthy subjects (11 men) in their mid-twenties to consume a non-fatty dinner the evening before the study and a light breakfast on the day of the study.

They were then asked to fast for 2 hours before each scan in which plasma CCK concentration was assessed.

Subjects were then asked to consume a flavoured no-fat control stimulus and a flavoured oral fat stimulus.

A randomised two-way crossover design was then used to assess the effect of the prior consumption of either a 250 ml high fat meal which totalled 520 kcal and consisted of rapeseed oil, emulsifier, sucrose and flavour cocktail, or a non-caloric water load on the BOLD response to the oral control stimulus and fat stimulus. Subjects were then examined in two scan sessions one week apart.

The high fat meal totalled 520 kcal and consisted of rapeseed oil, emulsifier, sucrose and flavour cocktail. ©iStock

Results revealed that compared to the water load, consuming the high fat meal led to decreased taste activation in response to both the control stimulus and fat stimulus.

The high fat meal also caused reduced activation in response to the fat stimulus compared to the control stimulus (fat-related satiety).

Additional results also found an individual's plasma CCK concentration correlated negatively with brain activation in taste and oral somatosensory and reward areas.

"We have shown that the prior consumption of a high fat meal leads to an increased CCK concentration and subjective ratings of fullness," the study said.

"Individual subjects' plasma CCK concentrations negatively correlated with BOLD activation in taste and reward areas. This suggests that taste, appetite, and reward-related areas are responsive to nutritional status and, as such, receive not only sensory signals but also introspective signals of motivation and/or hedonic value."

Previous **studies** looking into fat emulsions and flavour have yielded similar observations in which the effect of high fat foods was linked to a self-reported preference of these samples.

Additionally, a specific brain response was observed in primary taste and reward areas.

Brain power

In trying to explain the effect of increasing CCK concentration after the high fat meal, the researchers identified several brain areas that showed a negative correlation of BOLD activation to the control stimulus and fat stimulus.

These included the amygdala; superior temporal gyrus; supramarginal gyrus; precentral gyrus; and cerebellum.

"Previous work has shown that an infusion of CCK or consumption of a high fat meal produces an elevation of CCK concentrations and greater feelings of satiety," the study concluded.

The decrease of BOLD response to the control stimulus and fat stimulus in the amygdala with increasing CCK concentrations herein supports a decrease in reward response resulting from satiation.

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"Prior Consumption of a Fat Meal in Healthy Adults Modulates the Brain's Response to Fat."

Authors: Susan Francis et al

The amygdala and cerebellum are areas of the brain implicated in satiety and the reward response. ©iStock