

## Chewing more may increase satiety but did not reduce food intake at next meal

17 September 2013

Researchers from the departments of Food Science and Human Nutrition, and Biomedical Sciences of Iowa State University (USA), found that chewing food longer reduced appetite after eating, but did not lower food intake at the next meal. This was coupled with an increased blood glucose response and higher plasma concentrations of cholecystokinin (CCK) and lower levels of ghrelin, which indicate increased satiety. When the satiety of food is higher, it makes our appetite for eating again stay away for longer.

The high prevalence of overweight and obesity demands the exploration of new strategies to aid weight management. Understanding the factors that might influence satiety, such as the number of chews (or masticatory cycles) before swallowing, could help in controlling appetite and food intake. Chewing reduces the particle size of food, which facilitates digestion. How much food is chewed, depends not only on the food itself, but also on how it has been processed, and on the person who eats it. There can be a large variation in the amount of masticatory cycles between people. It has been reported that eating fast, taking large bites, and swallowing quickly can promote overeating, and is associated with a higher body weight. With the current study, the researchers wanted to investigate whether chewing longer affects postprandial (after-meal) satiety, the postprandial blood glucose response, and the amount of food consumed during the next meal.

After an overnight fasting period, twenty-one healthy males with normal body weights were asked to consume a pizza (183 grams, 490 kilocalories), which was cut into 24 equal-sized portions (3.8 x 2.5 cm). The participants were instructed to chew each portion either 15 or 40 times before swallowing. The subjective appetite – before and at several time points after the meal – was evaluated through a questionnaire with four questions: How hungry do you feel right now? How full do you feel right now? How preoccupied with food are you right now? What is your desire to eat right now? To measure satiety related hormones, glucose, and other markers, blood samples were taken at several points in time. To study the effect on satiety, a pasta meal was provided three hours after the pizza meal. This time, no instructions for chewing were given and the participants were informed that they could eat as much food as they wanted.

The results from the questionnaire showed that individuals who chewed 40 times had a positive effect on satiety after the meal, compared to those that chewed their food only 15 times: those chewing more were less hungry, less preoccupied with food, and had less desire to eat. A difference in the feeling of fullness was not found. A higher number of masticatory cycles also resulted in a higher plasma concentration of CCK (suppresses hunger) and a trend towards a lower level of ghrelin (induces appetite), two markers for increased satiety. Moreover, increased chewing resulted in higher levels of postprandial glucose, insulin, and glucose-dependent insulinotropic peptide, which indicate that food is digested, and the nutrients transported to the blood, faster. However, those that chew more did not eat less during their next meal.

The mechanism behind the higher secretion of satiety-related hormones, which appears to be induced by

more chewing is unclear. The authors hypothesise there could be a neural response in the brain regions responsible for hormonal secretion. However, they suggest that a more likely explanation is the faster release of nutrients from the food, or increased bioavailability, as a result of the reduced particle sizes. The release of both CCK and ghrelin is affected by the presence of nutrients in the gastrointestinal tract.

The authors conclude that their findings indicate that chewing more enhances satiety, and at the same time chewing less may increase the risk of weight gain due to reduced satiety. However, increased mastication did not result in eating less three hours later, and the longer term effects are unknown. Moreover, they acknowledge that an important limitation of the study is that the effect of mastication cannot be isolated from other factors that may have led to increased satiety. These other factors are for instance eating rate, oral processing time, and the physical characteristics of the food bolus that is swallowed; an incentive for further research, they say. Future studies should also test other types of foods, examine mastication behaviours in women, lean versus people with obesity, and look into potential health effects of the increased blood glucose response.

For further information please see:

[Zhu Y, Hsu WH & Hollis JH \(2013\). Increasing the number of masticatory cycles is associated with reduced appetite and altered postprandial plasma concentrations of gut hormones, insulin and glucose. British Journal of Nutrition 110: 384–390.](#)