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RSNA15: Smell of Food Activates Impulse Area in Brain

An imaging study shows that the area of the brain associated with impulsivity and the development of obsessive-compulsive disorder is activated in obese children when introduced to food smells. The findings suggest that obesity has a neurological disorder component and could help inform treatment of obese patients.

The study, which was led by Dr. Pilar Dies-Suarez, chief radiologist at the Hospital Infantil de México Federico Gómez, will be presented next week at the annual meeting of the Radiological Society of North America (RSNA) in Chicago.

A report from the Centers for Disease Control and Prevention (CDC) says that nearly 12.7 million children in the U.S. are obese. These children are at a higher risk to develop type 2 diabetes, high blood pressure, and breathing and joint problems, amongst many other health issues. They are also more likely to become obese adults.

Two magnetic resonance imaging (MRI) techniques — functional MRI (fMRI) and functional connectivity MRI (fcMRI) — were used for the study that included 30 children between the ages of 6 and 10. Half of the children had a normal body mass index (BMI) between 19 and 24, and the other half exhibited a BMI over 30, which is classified as obese. Each child was presented with three odour samples: chocolate, onion and a neutral odour of diluted acetone. As the participants smelled the samples, both the fMRI and fcMRI were used to measure brain activity.

An evaluation of the fMRI results showed that in the obese children, the food odours triggered activation in the areas of the brain associated with impulse and the development of obsessive-compulsive disorder, while the areas of the brain associated with impulse control exhibited no activity. However, in the children with a normal BMI, the areas of the brain associated with pleasure regulation, organisation and planning, as well as regions governing emotional processing or memory function, became more active.

In addition, the fcMRI results showed that when the normal-weight children smelled the onion, there was a connection between the gustatory cortex, which processes taste, and the area of the brain linked to reward anticipation. This connection did not occur in the obese children.

The researchers note that the chocolate smell elicited significant brain connections in obese children, compared to the normal-weight children.

"If we are able to identify the mechanisms that cause obesity, we will be able to change the way we treat these patients, and in turn, reduce obesity prevalence and save lives," Dr. Dies-Suarez points out.

Figure 1. fMR image showing brain activation patterns in obese vs. normal-weight children when presented with chocolate odour.

Figure 2. This figure presents the different connections found for the normal weight vs. obese children depending on smell: Onion (1A), acetone (1B) and chocolate (1C). The red lines correspond to connections which were larger for normal weight vs. obese children. The blue lines correspond to stronger connections between the normal weight vs. obese children.

Source and image credit: Radiological Society of North America

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