Field:

Bioscience/Life Science

Session Topic:

Body fat: hidden organ, new source of hormonal regulation

Speaker:

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The devastating health and emotional impact of obesity is no longer confined to just adults. Recent statistics show that 22 million children under five are estimated to be overweight worldwide. Recent findings in pediatric research have uncovered a significant piece of the obesity puzzle: beyond merely the effects of diet and lack of exercise, a child's risk of obesity can also be determined during the critical perinatal stage, that is, the period during and around birth. Central to this field is the concept of "perinatal programming", defined broadly as a process where a stimulus at a critical period of development may have long-term or even lifetime effects. Data from both human studies and animal models have revealed that obesity risk is greatly influenced by two major factors: the nutritional and hormonal conditions of the mother during pregnancy and the nutritional and hormonal conditions of the child in early infanthood, with both perinatal malnutrition as well as over-nutrition being risk factors for the child becoming overweight or obese. We have also known for decades that the brain, and particularly a region of the brain called the hypothalamus, plays a key role in regulating food intake and body weight. A collection of brain cells (neurons) in the hypothalamus coordinates our need to eat in relation to how well our body is fed via cross talk with hormone signals arising from the gastrointestinal tract and adipose tissue.

The critical brain growth and development period takes place during the intra-uterine life up to the first years of life. During this time, the brain is highly sensitive and a change in environment, particularly in regard to hormones and nutrition, could have an adverse effect on the organ. Experimental evidence suggests that development of programming in brain circuitry that controls appetite by the perinatal environment could predispose an individual to become overweight or obese. For example, we have recently shown that the fat hormone leptin and the gut hormone ghrelin work on the brain (on the hypothalamus) during early life to regulate the growth of nerve cells (axons) that control eating. In addition, nutritional manipulation of hormone secretion during perinatal life has generated considerable concern, and the developing brain appears to be a particularly sensitive target for these environmental changes, with both perinatal undernutrition and overnutrition having adverse consequences on the architecture of brain circuits involved in appetite regulation.

These intriguing results suggest that predisposition to obesity might be hardwired at or around birth and that adequate nutrition during early life is essential for proper development of brain centers involved in food intake and body weight regulation.