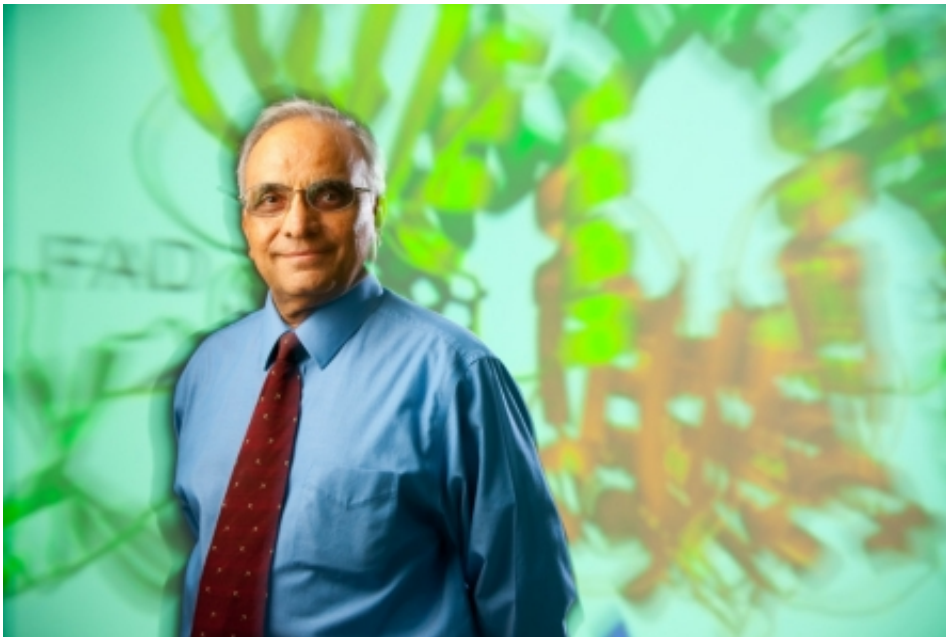


High-carb intake in infancy has lifelong effects, study finds

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Patel's research at the University at Buffalo shows how a high-carb diet early in life programs individuals for obesity later on. Credit: Douglas Levere

Consumption of foods high in carbohydrates immediately after birth programs individuals for lifelong increased weight gain and obesity, a University at Buffalo animal study has found, even if caloric intake is restricted in adulthood for a period of time.

The research on laboratory animals was published this month in the *American Journal of Physiology: Endocrinology and Metabolism*; it was

published online in December.

"This is the first time that we have shown in our rat model of obesity that there is a resistance to the reversal of this programming effect in adult life," explains Mulchand S. Patel, PhD, SUNY Distinguished Professor of Biochemistry and associate dean for research and biomedical education in the UB School of Medicine and Biomedical Sciences.

The research has applications to the [obesity epidemic](#) in the U.S., particularly as it relates to infant nutrition, Patel explains.

"Many American baby foods and juices are high in carbohydrates, mainly simple sugars," he says. "Our hypothesis has been that the introduction of baby foods too early in life increases [carbohydrate intake](#), thereby boosting [insulin secretion](#) and causing metabolic programming that in turn, predisposes the child to obesity later in life."

For more than 20 years, Patel and his UB colleagues have studied how the increased intake of carbohydrate-enriched calories just after birth can program individuals to overeat.

For their [rat model](#) of obesity, the UB researchers administered to newborn rat pups special milk formulas they developed that are either similar to rat milk in composition, (higher in fat-derived calories) or enriched with carbohydrate-derived calories.

"These pups who were fed a high-carbohydrate milk formula are getting a different kind of nourishment than they normally would," explains Patel, "which metabolically programs them to develop hyperinsulinemia, a precursor for obesity and type 2 diabetes."

At three weeks of age, the rat pups fed the high-carbohydrate (HC) formula were then weaned onto rat chow either with free access to food

or with a moderate calorie restriction, so that their level of consumption would be the same as pups reared naturally.

"When food intake for the HC rats was controlled to a normal level, the pups grew at a normal rate, similar to that of pups fed by their mothers," Patel says. "But we wanted to know, did that period of moderate calorie restriction cause the animals to be truly reprogrammed? We knew that the proof would come once we allowed them to eat ad libitum, without any restrictions.

"We found that when the HC rat undergoes metabolic reprogramming for development of obesity in early postnatal life, and then is subjected to moderate [caloric restriction](#), similar to when an individual goes on a diet, the programming is only suppressed, not erased," he says.

This is due to developmental plasticity, which extends from fetal development into the immediate postnatal period. According to Patel, previous research by others has revealed that during the immediate postnatal period, pancreatic islets and neurons continue to mature.

"That's why an altered nutritional experience during this critical period can independently modify the way certain organs in the body develop, resulting in programming effects that manifest later in life," Patel says. "During this critical period, the hypothalamus, which regulates appetite, becomes programmed to drive the individual to eat more food. We found that a period of moderate caloric restriction later in life cannot reverse this programming effect."

Therefore, addressing the obesity epidemic in the U.S. requires true lifestyle change, including permanent caloric restriction.

"As long as you restrict intake, you can maintain normal body weight," he says.

To avoid metabolic reprogramming that predisposes a baby to [obesity](#) later in life, he says that parents should follow the American Academy of Pediatric guidelines, which state that solid foods should not be given before a baby is 4-6 months old.

Patel adds that this study involved only moderate caloric restriction; he and his colleagues would like to study whether or not more severe caloric restriction for a limited period can result in true metabolic reprogramming to normal metabolic phenotype.

Provided by University at Buffalo

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