

# Obesity and metabolic syndrome associated with impaired brain function in adolescents

September 3 2012

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A new study by researchers at NYU School of Medicine reveals for the first time that metabolic syndrome (MetS) is associated with cognitive and brain impairments in adolescents and calls for pediatricians to take this into account when considering the early treatment of childhood obesity.

The study, funded by the National Institutes of Health under award number DK083537, and in part by award number 1UL1RR029892, from the National Center for Research Resources, appears online September 3 in *Pediatrics*.

As [childhood obesity](#) has increased in the U.S., so has the prevalence of [metabolic syndrome](#) – a [constellation](#) of three or more of five defined [health problems](#), including abdominal obesity, low HDL (good cholesterol), high [triglycerides](#), [high blood pressure](#) and pre-diabetic [insulin resistance](#). Lead investigator Antonio Convit, MD, professor of psychiatry and medicine at NYU School of Medicine and a member of the Nathan Kline Research Institute, and colleagues have shown previously that metabolic syndrome has been linked to neurocognitive impairments in adults, but this association was generally thought to be a long-term effect of poor [metabolism](#). Now, the research team has revealed even worse brain impairments in [adolescents](#) with metabolic syndrome, a group absent of clinically-manifest vascular disease and likely shorter duration of poor metabolism.

"The prevalence of MetS parallels the rise in childhood obesity," Dr.

Convit said. "There are huge numbers of people out there who have problems with their weight. If those problems persist long enough, they will lead to the development of MetS and diabetes. As yet, there has been very little information available about what happens to the brain in the setting of obesity and MetS and before diabetes onset in children."

For the study, the researchers compared 49 adolescents with metabolic syndrome to 62 teens without the disorder. Of those who were not in the MetS group, 40 percent were considered overweight or obese, so while they were not in ideal health, they did not have three out of the five health issues needed to fall into the MetS group. The findings reported, therefore, are conservative and reflective of the real world.

Dr. Convit and colleagues balanced each group according to age, socioeconomic status, school grade, gender and ethnicity to ensure things like cultural differences in diet and access to quality healthcare did not cloud the data. They then conducted endocrine, MRI and neuropsychological evaluations on the adolescents and found that those classified as having MetS showed significantly lower math and spelling scores, as well as decreased attention span and mental flexibility. They also showed differences in brain structure and volume, presenting with smaller hippocampal volumes – involved in the learning and recall of new information, increased brain cerebrospinal fluid and reductions of microstructural integrity in major white matter tracts in the brain. The more MetS-characterizing health problems the participants had, the more profound the effect across the board.

"The kids with MetS took longer to do tasks, could not read as well and had poorer math scores," Dr. Convit said. "These findings indicate that kids with MetS do not perform well on things that are very relevant to school performance."

The researchers concluded that even a few years of problems with

metabolism may cause brain complications. They suggest the adverse impact of MetS on brain function in children could be used by pediatricians as a powerful motivator to get families more involved in meaningful lifestyle change.

"Only now are pediatricians becoming aware of some of these issues," Dr. Convit explained. "Many pediatricians don't even take a blood pressure, and they certainly are not taking cholesterol levels and testing insulin resistance." He added that about one third of children who are obese have abnormal cholesterol levels and more than 40 percent of those who are really obese have insulin resistance. "Obesity in kids is sky-high. Nearly 40 percent of the U.S. population is considered obese. Parents need to understand that obesity has medical consequences, even in children, and some of those consequences may be impacting more than just the long term health of the cardiovascular system. We need to do what our grandmothers have told us all along: 'Eat well, don't overeat and try to move as much as possible.'"

Dr. Convit added that simple changes in daily routine would go a long way in preventing MetS – changes like walking more and taking the stairs. Future research is needed to determine whether the reductions in cognitive performance and structural brain abnormalities are reversible with significant weight loss, he explained.

"The take home message is that just being overweight and obese is already impacting your brain," Dr. Convit said. "Kids who are struggling with their weight and moving toward having MetS may have lower grades, which could ultimately lead to lower professional achievement in the long run. These are run-of-the-mill, garden-variety kids, not kids that came into the hospital because they were sick. It is imperative that we take obesity and physical activity seriously in children. In this country, we're taking away gym class in order to give children more class time in an effort to improve school performance, but that effort may be having

the exact opposite effect."

Dr. Convit's focus on combating and raising awareness about the impact of childhood obesity led him to create the The BODY Project, a program that works with New York City schools and parents to evaluate students' height, weight, blood pressure, test for insulin resistance and record other measures of health, giving parents an overview of their child's health status. Simply receiving this report motivates visits to the [pediatrician](#), meal-planning changes at home and other interventions to prevent MetS and obesity. The program has impacted more than 3,400 children since its creation four years ago.

"If we can help one kid not become diabetic, that's one kid's life we've saved," Dr. Convit said.

Provided by New York University School of Medicine

Citation: Obesity and metabolic syndrome associated with impaired brain function in adolescents (2012, September 3) retrieved 20 April 2024 from <https://medicalxpress.com/news/2012-09-obesity-metabolic-syndrome-impaired-brain.html>

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