

High cholesterol levels drop naturally in children on high-fat anti-seizure diet, study show

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Elevated cholesterol levels return to normal or near normal levels over time in four out of 10 children with uncontrollable epilepsy treated with the high-fat ketogenic diet, according to results of a Johns Hopkins Children's Center study reported in the *Journal of Child Neurology*.

In the four-year study, the Hopkins Children's team followed 121 epileptic children with intractable seizures on the high-fat, low-carbohydrate ketogenic diet designed to control such seizures. While most children developed high cholesterol after starting the diet, cholesterol gradually improved in nearly half of them, returning to normal or near-normal levels, with or without modifications to their diet to reduce fat intake.

In fact, researchers point out, diet modifications-including reducing total fat content or certain types of fats called saturated fats and adding nutritional supplements-reduced high cholesterol just as much as doing nothing. High cholesterol is defined as total cholesterol greater than 200 mg per deciliter of blood, bad or LDL (low-density lipoprotein) cholesterol greater than 130, triglycerides greater than 130, and good or HDL (high-density lipoprotein) lower than 35.

Researchers prescribed dietary modifications to increase "good," polyunsaturated fats in the diets of 15 children with elevated cholesterol. Dietary modifications decreased cholesterol by 20 percent in 9 out of the

15 (60 percent) children whose diets were modified. Surprisingly, cholesterol also dropped by at least 20 percent in 41 percent of the 37 children whose diets remained unchanged. The findings, while encouraging overall, also mean that relying on diet changes alone may not do much for those children in whom cholesterol remains persistently elevated, and that new approaches for these patients are needed, researchers say.

The findings should come as comforting news to pediatric neurologists, general pediatricians and parents of children treated with the ketogenic diet, and reassure them that, in most patients, increases in cholesterol may be short-lived, researchers say. Previous long-term studies by the Hopkins group of children who were on the diet between six and 12 years echoed these findings. The ketogenic diet, believed to work by triggering biochemical changes that eliminate seizure-provoking short-circuits in the brain's signaling system, is used in many children with hard-to-control epilepsy and in those whose seizures do not respond to traditional anticonvulsant medications.

"We are greatly encouraged by our findings because the nearly half of the children on the diet were either able to maintain healthy cholesterol or gradually metabolized the extra fat and returned to somewhat normal cholesterol levels," says senior investigator Eric Kossoff, M.D., a pediatric neurologist at Hopkins Children's. "This means the benefits of the diet—a diet that is lifesaving in many children and therapeutic in most of them—continue to outweigh the risks."

Noting that 40 percent of children maintained normal cholesterol even after starting the diet, researchers found that children fed a formula-based, liquid-only ketogenic diet were nearly three times less likely to develop high cholesterol. Researchers attribute this finding to the nearly zero fat content in commonly used ketogenic diet formulas.

In the group with normal cholesterol, 78 percent of children (31 out of 40) were fed formula-based ketogenic diet. This finding, while requiring further study, points to another possible treatment for high cholesterol, Kossoff says, by switching children with persistently elevated cholesterol to formula-based ketogenic diets at least some of the time. The formula-based ketogenic diet contains only one-third the amount of saturated fats—the worst kind in terms of cholesterol—of the solid food version of the ketogenic diet. Because doctors can tweak the ratio of fat vs. carbohydrates depending on each child's severity of seizures, the investigators examined whether higher-fat versions of the ketogenic diet raised cholesterol additionally, but found that higher-fat ratio did not make cholesterol worse than a lower-fat ratio.

Some of the other findings:

-- One-fourth of 121 children had elevated total cholesterol before starting the diet, which increased to 60 percent (59 out of 99 children at follow-up) after the initiation of the diet.

-- 18 percent (22 out of 119) had triglycerides over 130 before the diet, which increased to 51 percent (49 out of 96) after starting the diet.

-- 19 percent (21 out 110) had bad cholesterol over 130 before the diet, which increased to 53 percent (48 out of 93) after starting the diet.

The study appears online ahead of print at <http://jcn.sagepub.com/cgi/reprint/23/7/758>.

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