The Insulin Connection

By Brenda Goodman

Diabetes drugs have made a big difference to George Marincin and Kristin Chapman. For a few weeks last year, Marincin, 77, from Tacoma, Wash., took artificial insulin, the hormone that's deficient in diabetics. And every day Chapman downs doses of Glucophage, a drug that helps the 38-year-old from Atlanta to better control the hormone.

But neither Marincin nor Chapman has diabetes.

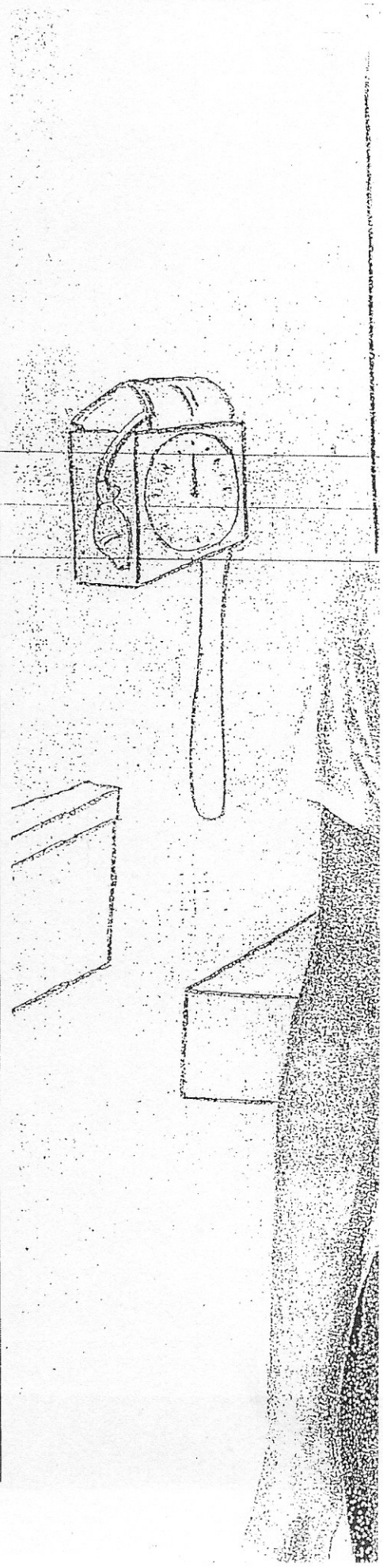
What Marincin does have is Alzheimer's disease. He took insulin to test the idea that low levels might be linked to memory problems. "I did wonder how insulin could help George because he's not diabetic," says his wife, Mabel. "But it has. It's wonderful." Her husband has regained his sense of humor and can even complete simple tasks again like making a cup of tea, she says. Last month his doctors reported in the *Archives of Neurology* that other patients also seemed to benefit.

Chapman was just as surprised that adjusting insulin levels could help her. She has polycystic ovary syndrome, which causes infertility and dramatically raises her risk for heart disease. But her problem wasn't too little insulin but too much, which prevents ovulation. After seven years of struggling to conceive, she started taking Glucophage and was pregnant in a month. "It's mind boggling, isn't it?" she says. Now the happy mother of two kids, she'll stay on the drug for the rest of her life to keep her high insulin in check.

Insulin problems—too much or too little—go far, far beyond diabetes. The condition is called insulin resistance and, in addition to the ailments dogging Chapman and Marincin, doctors are now discovering it is linked to heart attacks, strokes, and several kinds of cancer and may affect 1 in 3 American adults. These findings have alarmed many specialists. "Insulin resistance is very common, and it's associated with the biggest killers," says endocrinologist Ronald Kahn, director of the Joslin Diabetes Center at Harvard University. "If we don't start paying attention to this now, we're all going to be paying a huge price for this condition." Physician David Katz, director of the Prevention Research Center at Yale Medical School, adds that "we're just beginning to understand that insulin throws a lot of big switches in the body. Is insulin *the* master control of all disease? I don't know, but it's certainly a candidate for that role."

One hormone may cause cancer, heart attacks, and many more ills.

Insulin's main job is to escort sugar out of the blood and into muscle and fat cells. But sometimes those cells resist letting it in. So the pancreas, which makes insulin, tries to crank out even more. If it can't, blood sugar climbs to dangerous levels and the result is Type II diabetes. More often, however, the pancreas *does* make more insulin. The extra hormone may restore blood sugar to normal, but it overwhelms the rest of the body. That spells trouble, because insulin is more than just a sugar ferry. It tells the kidneys, for example, to hold on to salt. And more salt means hypertension. It tells cancer cells to grow, and that can mean a tumor.



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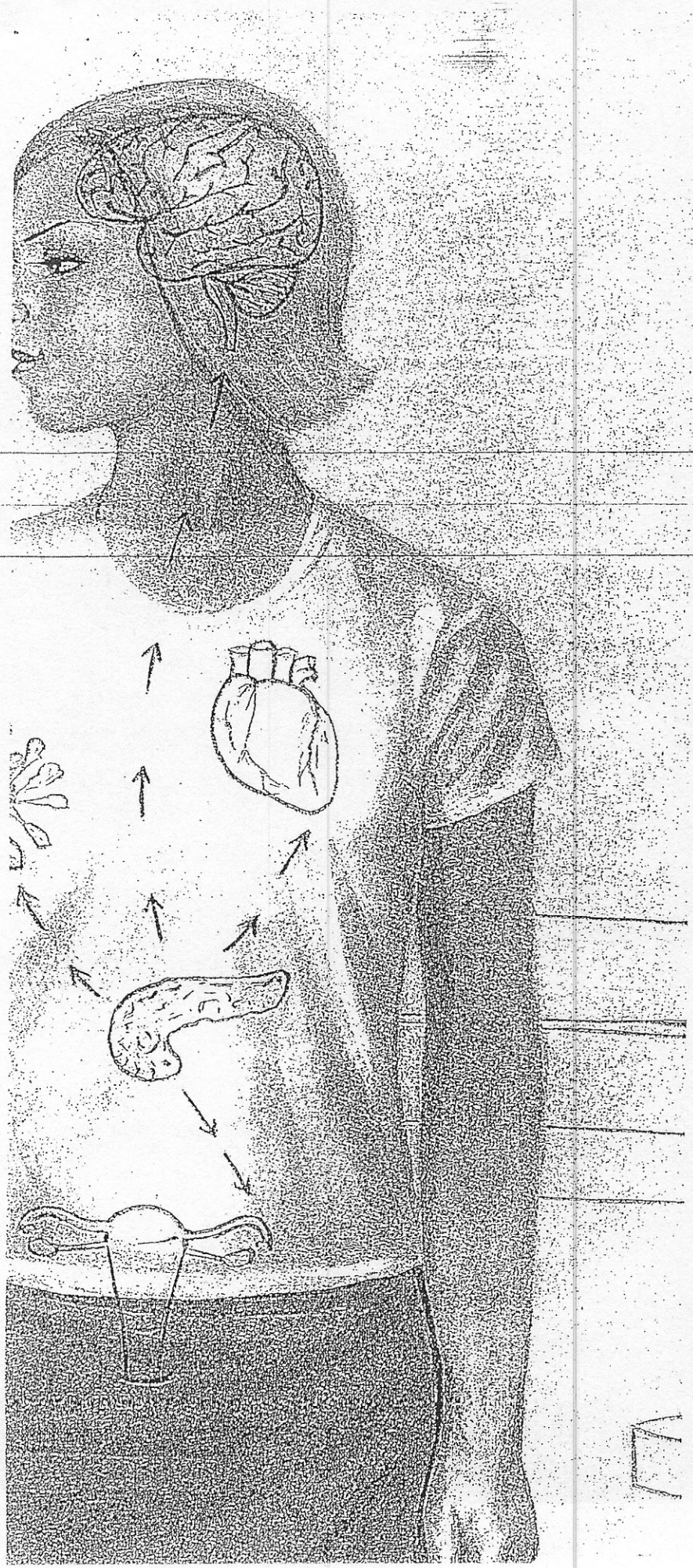
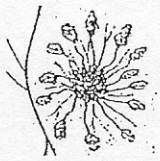


Fortunately, doctors are starting to devise new ways to treat insulin resistance—which is sometimes called "metabolic syndrome"—with drugs and lifestyle changes. They are still working out all the connections, but already they have a list of some of the leading insulin-related illnesses:

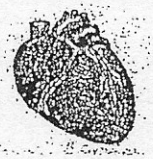
Cancer



Insulin stimulates cell growth, and unfortunately cancer cells have six to 10 times the number of insulin receptors—molecules that grab on to the hormone—as do normal cells. So if extra hormone hits a pre-existing cancer cell, it makes a bad thing much, much worse. "For cancer, insulin is like pouring gasoline on a fire," says Edward Giovannucci, who studies the epidemiology of colon cancer at the Harvard School of Public Health.

Colon, breast, endometrial, pancreatic, and prostate cancers seem especially responsive. "We think breast cancer cells may have very special kinds of receptors, fetal insulin receptors, that are ultrasensitive to insulin," says Pamela Goodwin, director of the Marvelle Koffler Breast Center at Mount Sinai Hospital in Toronto. Insulin may also influence estrogen, another hormone that can trigger tumor growth. "So if you turn on one hormone, you turn on the other," Goodwin says. She is currently testing Glucophage to see if it can lower insulin levels in breast cancer survivors and plans to see if this affects cancer recurrence.

Cardiovascular Disease



High levels of insulin in the blood damage the lining of arteries, increase bad blood fats such as triglycerides and LDL cholesterol, and clump blood cells together so they are more likely to block up vessels. These observations prompted Gerald Reaven, the Stanford endocrinologist who first described insulin resistance in the 1980s, to finger the condition for heart attacks, strokes, and cases of high blood pressure.

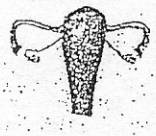
Other research has come to back him up. A major study by Finnish researchers in the journal *Circulation* followed almost 1,000 men for 22 years and found insulin levels alone were the most powerful predictors of heart attack risk, especially in younger men. They were more powerful than obesity levels and physical inactivity, for example. Men with the

highest insulin levels had more than three times the heart attack risk of those with the lowest.

The concept does have its critics. Last week in the journal *Diabetes Care*, Richard Kahn, chief scientific and medical officer for the American Diabetes Association, wrote an article questioning whether the idea of insulin resistance is truly useful, particularly when it comes to diagnosing and helping heart patients. Just calling something by a new name, he argues, doesn't change the recommended therapies. "I don't see the value . . . especially when the treatments are the same," says Kahn. He points out that if patients have high cholesterol, they're going to get cholesterol-lowering drugs and advice on diet and exercise, whether or not insulin resistance is the root cause.

But other experts see value in understanding insulin's role in the clustering of cardiovascular risk factors, particularly if it points the way toward new treatments. It's already doing that for stroke, for it's here that one new treatment is being tested. This spring the National Institutes of Health began a study at more than 60 research sites to see if the drug Actos, an insulin sensitizer, can reduce stroke recurrence in certain patients.

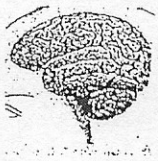
Ovary Disease



According to the American Association of Clinical Endocrinologists, polycystic ovary syndrome affects 1 in 10 women and is the leading cause of infertility in the United States. High levels of insulin trigger excess production of other hormones by the ovaries, disrupting regular egg growth and menstrual cycles and preventing pregnancy. Some of these overproduced hormones, or androgens, can also cause male-pattern hair growth on the face and some other unpleasant appearance changes. Basically, says Mark Perloe, an Atlanta endocrinologist and polycystic ovary syndrome specialist, "insulin is driving the ovary crazy."

Doctors now treat this ovary syndrome with insulin-sensitizing medications like those taken by Chapman, and also recommend weight loss, which lowers insulin levels. Treatment is important even beyond fertility problems, because untreated women with the polycystic syndrome have more than seven times the risk of heart disease and three times the risk of diabetes of women without it.

Alzheimer's



Cells in the brain's memory and learning centers have a lot of insulin receptors. A quick spike in insulin improves memory and performance; take insulin away, and brain function begins to decline. But paradoxically, more insulin in the blood—insulin resistance—means less in the brain. One leading theory: Insulin's corrosive effects on blood vessel linings gums up tiny portals in the vessels that supply the brain, making it harder for the hormone to bring in sugar. Ultimately, this starves brain cells, suggests researcher Suzanne Craft of Veterans Administration Puget Sound Health Care System. That could set the stage for some cases of Alzheimer's, Parkinson's, and Huntington's diseases. Insulin also seems to clear away some beta-amyloid, a substance long implicated in Alzheimer's damage, so less of it could cause problems.

There are, of course, many theories about Alzheimer's, and this is far from the final word. But whatever the reason for the disease, there is preliminary evidence that getting insulin to the brains of Alzheimer's patients improves symptoms. In Craft's recent study, a small group of Alzheimer's patients, including Marincin, inhaled insulin. (Inhalation provides more of the hormone to the brain.) Compared with a group that only inhaled saline solution, these patients better recalled stories and lists. It's not known, however, how long these improvements last. Craft is now testing the insulin sensitizer Avandia in people with Alzheimer's to see if it might slow down the disease.

THE TESTS OF ALL THESE DRUGS MAY sound good, but they are far from the only treatment—or the best—for insulin resistance. There's a lot of hope to be found around the dinner table. Most people with resistance can actually undo it by losing as little as 5 to 20 pounds. The best eating plans, say experts, offer lots of soluble fiber, the kind found in berries and beans and whole oats, which seems to indirectly diminish resistance, as well as lean proteins like fish. Saturated fats may cause insulin to spike, so look for foods with healthy fats like nuts and avocados. But enjoy them in moderation.

Weight loss is important because all the risks for all the diseases associated with insulin resistance are multiplied by obesity. That spare tire many of us carry around the middle packs the liver in fat, and the liver responds by tossing high levels of free fatty acids into the blood. These fats seem to block insulin from docking with its receptors on cells, increasing the risk of starting the resistance syndrome.

Regular exercise also helps muscles better use insulin, so in addition to her medication, Kristin Chapman works out four times a week. She also gets her heart checked every year, and has started getting regular mammograms early, at age 35. If insulin does indeed turn on many diseases, she plans on doing her best not to throw the switch. ●

ARE YOU INSULIN RESISTANT?

One in three American adults, or some 70 million people, may be insulin resistant. Yet making the diagnosis is challenging because there's no standard way to measure the level of insulin in the body at any given time. "One thing we really don't have is a good test for insulin resistance," says Ronald Kahn, director of the Joslin Diabetes Center at Harvard.

For that reason, physicians say that it's much easier to look for the consequences of having too much insulin, rather than insulin itself. The American Association of Clinical Endocrinologists suggests a diagnosis of resistance if a patient and doctor can put a checkmark next to at least two of these four measures:

- ☐ Triglycerides: greater than 150 mg/dL
- ☐ HDL cholesterol: less than 40 mg/dL in men or 50 mg/dL in women
- ☐ Blood pressure: greater than 130/85 mm Hg
- ☐ Blood glucose: 110–125 mg/dL after fasting and 140–200 mg/dL two hours after a glucose challenge

The endocrinology association says these tests are part of a regular physical, so anyone over 40 should be screened, as should those with a family history of diabetes, hypertension, or heart disease. Non-Caucasians, non-exercisers, and people who are overweight are also at increased risk of the condition. *–B.G.*

The Avandia confusion

1. The recent controversial and highly publicized study by Dr. Steve Nissen of the Cleveland Clinic was a "Meta Analysis" of 42 studies. A Meta Analysis is a statistical tool that takes many studies designed to show one thing, and tries to show something else.
2. Dr. Nissen is a **PAID** consultant of a company that ***COMPETES*** with the makers of Avandia!
3. There were 3,300 MORE people in the Avandia arm of the study group than in the "control" group.
4. **86** Heart Attacks out of **15,560** in the Avandia Arm,
   72 Heart Attacks out of **12,283** in the "control arm".
5. 86/15,560 x 1,000 = **5.527** heart attacks per 1,000 people vs.
   72/12,283 x 1,000 = **5.862** heart attacks per 1,000 people!
6. (5.862-5.527)/5.862 x 100 = **5.71% REDUCTION** in the number of heart attacks in those TAKING Avandia!!! Therefore, this "study" proves that Avandia actually **PREVENTS** heart attacks!!

**Moral of the story: You can get statistics to show anything you want them to show, especially if you "have it in" for the F.D.A. or your competition!

In Another study published online this week in the highly respected British medical journal, The Lancet.....

In a study of 5,000 people with **"Pre-Diabetes"**, **686/2,634** of people in the "placebo" or "control" arm ***developed Diabetes OR died***, compared to only **306/2,365** people on Avandia!

(686/2,634) x 100 = **26.04%** on placebo vs.
(306/2,635) x 100 = **11.61%** on Avandia!!

(686 – 306)/686 x 100 = **55.39% REDUCTION** in the risk of **developing Diabetes or dying** by taking Avandia for "*Pre-Diabetes*"!!!!

Dr. Moran is NOT a paid consultant of ANY pharmaceutical company, NOR does he have any shares of stock in any pharmaceutical company.

/31/07 05:31:28PM From: Clinical Insights in Diabetes To: DR. Mohsen :Sak

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This educational activity is designed for primary care physicians, internal medicine specialists, endocrinologists, diabetologists, cardiologists, and other healthcare professionals involved in the care and management of patients with type 2 diabetes, insulin resistance, and cardiovascular disease.

Learning Objectives
With information from the latest evidence-based studies, participants should be able to:

- Identify patients with insulin resistance, type 2 diabetes, and/or cardiovascular disease
- Select the most appropriate therapeutic regimen for patients with type 2 diabetes and its macrovascular and microvascular complications
- Identify risk factors for cardiovascular disease in patients with type 2 diabetes and select an appropriate therapeutic regimen

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Some of the drug treatments discussed in this issue may note uses not approved by the Food and Drug Administration. Articles containing such uses will be noted at the end of the article.

Additional PPS Staff Disclosures
Cynthia Foncan, MPA, is a Professional Postgraduate Services' Program Manager. She has indicated no relevant financial relationships.

Wadeelah Terry is a Professional Postgraduate Services' CME Program Manager. She has indicated no relevant financial relationships.

CLINICAL INSIGHTS® IN

Diabetes

VOLUME 10, NUMBER 7 • JULY 2007

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Intentional Weight Loss Improves Cardiovascular Disease Risk Factors in Type 2 Diabetes

The long-term effects of intentional weight loss on cardiovascular disease (CVD) risk reduction in the setting of type 2 diabetes are not known. As such, the Look AHEAD (Action for Health in Diabetes) trial, a National Institutes of Health–funded study, investigated the impact of intensive lifestyle intervention (ILI) on the incidence of major CVD events in overweight or obese adults with type 2 diabetes.

This 1-year trial was conducted at 16 centers in the United States and involved 5,145 individuals with type 2 diabetes, aged 45 to 74 years, with BMI >25 kg/m^2 (>27 kg/m^2 if taking insulin). Individuals were randomized to either ILI (n=2,570) or diabetes support and education (DSE) (n=2,575). ILI consisted of weekly group and individual meetings (biweekly after the first 6 months) designed to encourage patient weight loss through counseling in behavioral strategies for decreased caloric intake and increased physical activity. The DSE group attended 3 group sessions during the year after the initial sessions and received diet and fitness information but no counseling.

After 1 year, participants assigned to ILI lost significantly more of their initial weight (mean ± standard deviation [SD]) than participants assigned to DSE (8.6% ± 6.9% vs 0.7% ± 4.8%; $P<0.001$). Additionally, the individual weight loss goal of >10% of initial weight was met by 37.8% of participants in the ILI group versus only 3.2% of participants in the DSE group. Compared with the DSE group, the ILI group also demonstrated greater mean reductions in waist circumference (6.2 ± 10.2 cm vs 0.5 ± 8.5 cm; $P<0.001$). Mean fitness, as measured by a submaximal exercise test, increased by 20.9% ± 29.1% in the ILI group and 5.8% ± 22.0% in the DSE group ($P<0.001$). A1C, systolic and diastolic pressure, triglycerides, high-density lipoprotein cholesterol (HDL-C), and urine albumin-to-creatinine ratio ≥30.0 µg/mg improved significantly in the ILI group compared with the DSE group. Mean A1C was significantly reduced from 7.3% to 6.6% in the ILI group but showed little change (from 7.3% to 7.2%) in the DSE group ($P<0.001$). Systolic blood pressure decreased from 128 mm Hg to 121 mm Hg with ILI vs 129 mm Hg to 127 mm Hg with DSE ($P<0.001$). Diastolic blood pressure decreased from 70 mm Hg to 67 mm Hg with ILI vs 70 mm Hg to 69 mm Hg with DSE ($P<0.001$). HDL-C increased from 44 mg/dL to 47 mg/dL with ILI vs 44 mg/dL to 45 mg/dL with DSE ($P<0.001$). Triglycerides decreased from 183 mg/dL to 153 mg/dL with ILI vs 180 mg/dL to 165 mg/dL with DSE ($P<0.001$). There were also significant reductions in the ILI group compared with the DSE group in use of diabetes medications (-7.8% vs +2.2%; $P<0.001$), use of antihypertensive medications (-0.1% vs +2.2%; $P=0.02$), and use of lipid-lowering medications (+3.7% vs +9.4%; $P<0.001$).

Look AHEAD is the first large clinical trial comparing ILI with DSE among individuals with type 2 diabetes. This trial demonstrated that clinically significant weight loss in individuals with type 2 diabetes improves diabetes control and CVD risk factors while reducing the use of diabetes, antihypertensive, and lipid-lowering medications. The study investigators noted that continued follow-up is needed to determine whether these changes can be sustained and whether they reduce long-term CVD risk.

The Look AHEAD Research Group. Reduction in weight and cardiovascular disease risk factors in individuals with type 2 diabetes: one-year results of the Look AHEAD trial. *Diabetes Care*. 2007;30:1374-1383.

* Dr Inzucchi is a Professor of Medicine at Yale University School of Medicine and Clinical Director, Section of Endocrinology, Yale-New Haven Hospital, New Haven, Connecticut. He has indicated the following relevant financial relationships: retained consultant, Merck & Co., Inc., Novartis, Pfizer Inc, and Takeda Pharmaceuticals North America, Inc.; speakers bureau, Merck & Co., Inc., and Takeda Pharmaceuticals North America, Inc.; received grant research support from Eli Lilly and Company.

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HealthDay
News for Healthier Living

Obesity-Linked Woes Boost Kids' Lifetime Heart Risk

'Metabolic syndrome' includes higher blood pressure, cholesterol

By Alan Mozes
HealthDay Reporter

FRIDAY, Aug. 10 (HealthDay News) -- Obese children diagnosed with health problems collectively known as the "metabolic syndrome" are at higher risk for developing heart disease as adults, new research reveals.

Compared to healthier youngsters, school-age children with the condition face a 14.5 times greater risk of cardiovascular disease when they reached their 30s and 40s, the study found.

Components of the syndrome include high blood pressure, high body mass, high blood pressure and high triglycerides (blood fats).

"I wasn't exactly shocked, but this is the first time we have shown that children who have this constellation of factors known as metabolic syndrome are at an increased risk for cardiovascular disease in their adult years," said study lead author John A. Morrison, a research professor of pediatrics who also works in the division of cardiology at Cincinnati Children's Hospital Medical Center in Ohio.

The findings are published in the August issue of *Pediatrics*.

According to the American Heart Association, more than 50 million Americans have the metabolic syndrome. The condition is typically diagnosed on the basis of having at least three of the following characteristics: abdominal obesity; high blood pressure; insulin resistance (in which the body can't process insulin or blood sugar properly); a high risk for arterial plaque build-up due to high levels of triglycerides, low HDL ("good") cholesterol and high LDL ("bad") cholesterol; and a high risk for clotting and inflammation as indicated by the elevated presence of certain blood proteins.

Researchers long ago established that, for adults, having the metabolic syndrome increases their risk for both heart disease and diabetes. Physicians now recommend that patients combating the condition embark on a weight-loss program geared toward developing healthier eating habits and increased physical activity.

To explore a possible link between pediatric metabolic syndrome and adult heart disease, Morrison and his team cross-referenced data for contributing syndrome characteristics collected from a pool of 771 children between 1973 and 1978, and then again between 2000 and 2004.

The participants were drawn from the Cincinnati region and were between the ages of 6 and 19 in the first study and 30 and 48 in the follow-up study. A little less than three-quarters of the pool were white and a little more than a quarter were black.

Patient blood samples were taken the time of study enrollment and then 25 years later. The researchers gauged blood pressure; body mass index (BMI); and cholesterol. Blood triglyceride and glucose levels were also assessed.

The participants also reported any history of heart attack or stroke, or procedures such as coronary bypass or angioplasty.

Four percent of the participants -- 31 boys and girls -- had metabolic syndrome as children, while more than 25 percent had the condition 25 years later, the researchers reported.

Among those with pediatric metabolic syndrome, almost 70 percent still had the condition as adults, and almost 20 percent had gone on to develop cardiac disease in the intervening years.

In contrast, only 1.5 percent of the children who did not have the syndrome as kids went on to experience heart trouble as adults.

Furthermore, any rise or fall in BMI over the 25 years was linked to a concurrent rise or fall in risk for developing the metabolic syndrome. In that time frame, every BMI bump or drop of 10 points translated into a 24 percent risk increase or decrease for the syndrome, the team reported.

Morrison and his colleagues said their findings should help doctors and parents identify young patients who are at an increased risk for serious adult illness. They could also point the way toward ways to reduce that risk.

"So, there's some good news here," said Morrison. "Pediatric weight is not destiny. If you're obese as a child, you can do something to lose the pounds. And you must do something to lose the pounds, if you want to reduce risk."

Dr. Brenda Kohn, an associate professor of pediatrics at the New York University School of Medicine, added that proactive parental and physician intervention is critical to help children avoid behaviors that keep the syndrome going.

"The treatment has to be started in childhood, in adolescence," she advised. "Eating patterns, activity patterns, all start in infancy. Good habits have to start early."

"So, it's very, very important that a child is raised in an environment where physical exercise is encouraged on a routine basis and eating patterns are geared to healthy eating decisions," added Kohn, who is also a medical advisory board member with the Juvenile Diabetes Foundation. "Children should be monitored at least once yearly by a physician in order to ensure that all these goals are being met," she said.

More information

For additional information on metabolic syndrome, visit the **American Heart Association**.

SOURCES: John A. Morrison, Ph.D., research professor, pediatrics and division of cardiology, Cincinnati Children's Hospital Medical Center, Ohio; Brenda Kohn, M.D., associate professor, pediatrics, New York University School of Medicine, New York City, and member, medical advisory board, Juvenile Diabetes Foundation; August 2007, *Pediatrics*

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Drug That Treats Diabetes May Also Prevent It

Friday , September 15, 2006

Associated Press

A drug used to treat diabetes also seems to prevent it in people at high risk of developing the disease, the largest study ever to test this has found.

ADVERTISEMENT

The drug, rosiglitazone, or Avandia, appeared to cut the risk of developing diabetes or dying by more than half in the study. It also helped restore normal blood-sugar function in many participants.

A second part of the study found that a different drug, a blood pressure medication called ramipril, or Altace, made no difference in the risk of developing diabetes but helped normalize blood sugar for some.

The research was long-awaited, and the Avandia results at first glance seem impressive, but experts say it is difficult to determine how much impact the drug had, because study volunteers also were regularly counseled about healthy diets and lifestyles.

"We know that lifestyle changes alone can reduce the risk of developing diabetes by up to 58 percent," said Dr. Martin Abrahamson, medical director of the Joslin Diabetes Center in Boston, who had no ties to the study.

Those benefits come without the $100-a-month cost and side effects of Avandia, said Dr. Alvin Powers, director of diabetes research at Vanderbilt University Medical Center who also had no role in the research. He noted that a small percentage of those on Avandia developed heart failure.

Type 2 diabetes, the most common form and the type that is linked with obesity, is a growing problem worldwide. An estimated 220 million people around the world and 18 million Americans have the disease, which can lead to kidney failure, amputations and death. In Type 2 diabetes, the body does not make enough insulin or cannot effectively use the insulin it manages to produce.

Results of the drug study were to be presented Friday at a diabetes meeting in Denmark. The Avandia findings were published online by the British medical journal The Lancet; the Altace results were posted online by the New England Journal of Medicine. Both will appear in print editions later.

The study was paid for by the Canadian Institutes of Health Research and companies that make the drugs (GlaxoSmithKline PLC makes Avandia; Sanofi-Aventis SA and King Pharmaceuticals market Altace). Some study leaders consult for the drug companies.

The study involved about 5,000 people with "pre-diabetes," or blood-sugar abnormalities. Research suggests that as many as half of them will develop Type 2 diabetes within three years.

Doctors at McMaster University in Canada and in 20 other countries assigned these pre-diabetics to get either Avandia, Altace, both drugs or no drug.

Results for the combination treatment were not presented.

In the Lancet study, 306 of the 2,365 people given Avandia for an average of three years developed diabetes or died, compared with 686 of the 2,634 who did not receive the drug.

Fourteen of those given Avandia developed heart failure, while only two cases of heart failure occurred in people who didn't take the drug. Some doctors believe the heart risk is manageable as long as physicians carefully check patients taking the drug for heart abnormalities.

However, Powers said a drug to prevent one disease — diabetes — must not bring a substantial risk of another, or doctors will be unwilling to prescribe it— especially when lifestyle changes and other drugs such as metformin can prevent diabetes, too.

Still, some doctors were encouraged by Avandia's potential.

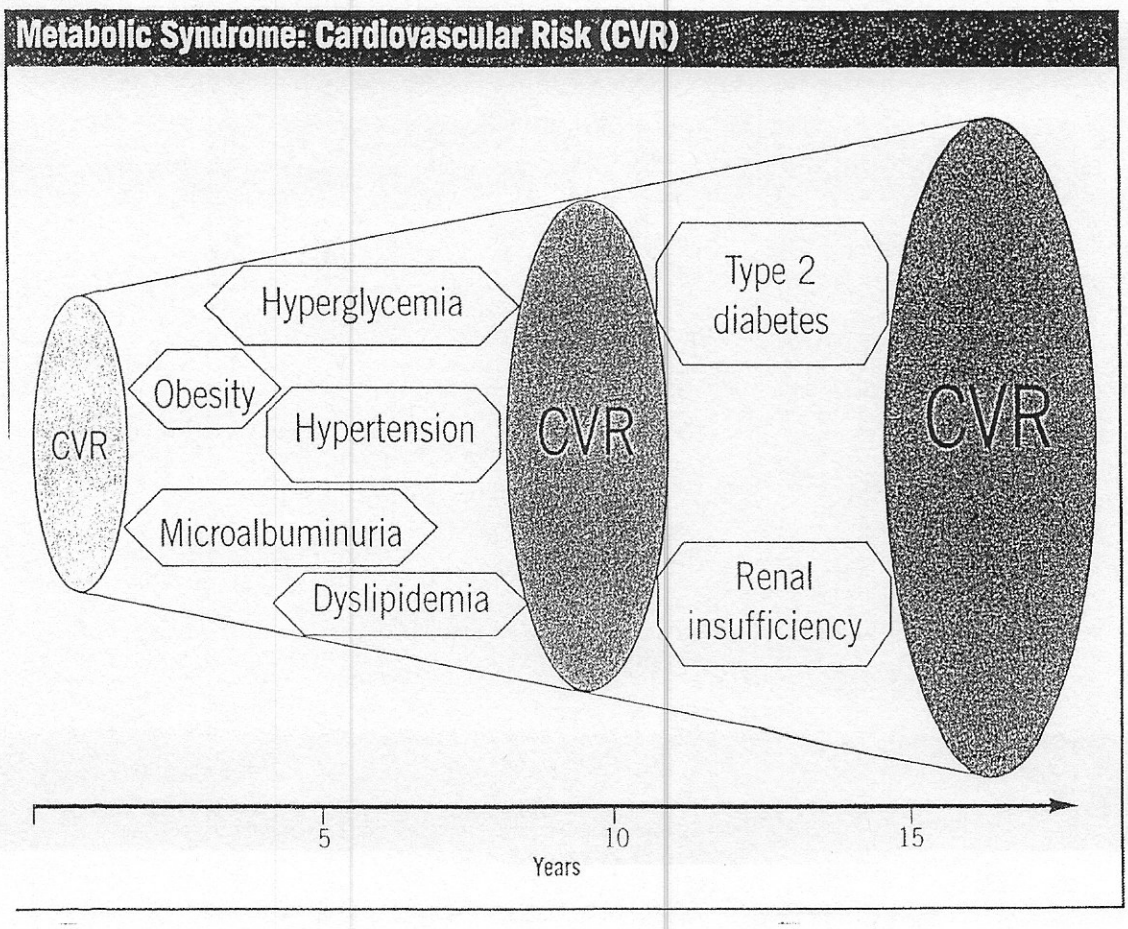
"This underscores the fact that diabetes is preventable, and that we might have another means to do that with,"

Defining Levels of Metabolic Syndrome Diagnostic Criteria

Criteria	NCEP ATP III*[3]	WHO†[4]	IDF‡[5]	
			Europeans	South Asians/Chinese/ Japanese
Abdominal obesity	Waist circumference: Men >102 cm (40 in) Women >88 cm (35 in)	Waist-to-hip ratio: Men >0.90, Women >0.85 *Or* BMI >30 kg/m^2	Waist circumference: Men ≥94 cm Women ≥80 cm	Waist circumference: Men ≥90 cm Women ≥80 cm
Triglycerides	≥150 mg/dL (1.7 mmol/L)	≥150 mg/dL (≥1.7 mmol/L)	≥150 mg/dL (1.7 mmol/L)	
HDL-C	Men <40 mg/dL (1.03 mmol/L) Women <50 mg/dL (1.29 mmol/L)	Men <35 mg/dL (0.9 mmol/L) Women <39 mg/dL (1.0 mmol/L)	Men <40 mg/dL (1.03 mmol/L) Women <50 mg/dL (1.29 mmol/L)	
Blood pressure	≥130/85 mm Hg	≥140/90 mm Hg	≥130/85 mm Hg	
Abnormal glucose metabolism	Fasting glucose ≥110 mg/dL (6.1 mmol/L)	Diabetes mellitus, impaired glucose tolerance, impaired fasting glucose, and/or insulin resistance	Fasting glucose ≥100 mg/dL (5.6 mmol/L)	
Microalbuminuria	N/A	Urinary albumin excretion rate ≥20 µg/min or albumin-to-creatinine ratio ≥30 mg/g	N/A	

*The NCEP ATP III criteria require ≥3 of these risk factors.
†The WHO requires diabetes, impaired glucose tolerance, impaired fasting glucose, or evidence of insulin resistance together with ≥2 of the other risk factors.
‡The IDF requires abdominal obesity plus ≥2 of the other risk factors.
NCEP ATP III = National Cholesterol Education Program Adult Treatment Panel III; WHO = World Health Organization; IDF = International Diabetes Federation; BMI = body mass index; HDL-C = high-density lipoprotein cholesterol.

FIGURE



DIETS FOR INSULIN RESISTANCE:

1. SUGAR BUSTERS DIET
2. SYNDROME X DIET
3. INSULIN RESISTANCE
4. CARBOHYDRATE ADDICTS
5. MEDITERRANEAN DIET
6. ~~THE ZONE DIET~~
7. SOUTH BEACH DIET – (modified)

K. I. S. S.

NATURAL INSULIN SENSITIZERS

1. CHROMIUM PICOLLINATE

400-600 mcg A DAY

2. L-ARGININE

500 MG A DAY

3. ALPHA-LIPOEIC ACID

50-100 MG A DAY

4. CINAMMON BARK OR EXTRACT

600 MG A DAY

5. Ginger 3 gms/d

GLYCEMIC INDEX OF FOOD

	HIGH GLYCEMIC INDEX	MEDIUM GLYCEMIC INDEX	LOW GLYCEMIC INDEX
Fruits	Bananas Raisins	Grapes Oranges Orange Juices	Apple Cherries Grapefruit Peaches Pears Plums Strawberries
Vegetables	Beets Carrots Turnip	Corn	Tomato Soup
Bread/Starch/ Grains	Rye Bread White Bread Whole Wheat Bread Fresh Broad Beans Corn Chips Parsnips Potato Fresh Mashed Potato Instant Mashed Potato Cornflakes Puffed Rice Shredded Wheat Swiss Muesli Millet White Rice	Pumpernickel Oatmeal Cookies Macaroni Baked Beans Frozen Peas New Potato Sweet Potato Yams Potato Chips Navy Beans Dried Peas All Bran Oatmeal Brown Rice Buckwheat Bulgar	Spaghetti Protein Enriched Spaghetti Blackeye Peas Butter Beans Garbanzo Beans Haricot Beans Kidney Beans Lentils Soy Beans Barley Rye
Dairy			Ice Cream Milk Yogurt
Fats/Oil			Peanuts
Other	Honey Table Sugar		Fructose

The following list is only a small sample of thousands of foods whose Glycemic Index is known. To determ the effect of foods on your blood sugar you should test your blood sugar 1-2 hours after eating. Additional resources to help you find the Glycemic Index of your favorite foods are found below**

Glycemic Index (GI) Rating

Beans
Baby lima 32
Baked 43
Black beans 30
Black eyed peas 42
Brown 38
Butter 31
Chickpeas 33
Kidney, cooked 27
Lentil 30
Navy 38
Pinto 42
Red lentils 27
Split peas 32
Soy 18

Grains
Barley 22
Brown rice 50
Buckwheat 54
Bulger 47
Chickpeas 36
Cornmeal 68
Couscous 65
Hominy 40
Rice, Instant 87
Rice long grain 55
Millet 75
Rye 34
Sweet corn 55
Wheat, whole 41

Cookies
Graham crackers 74
Oatmeal 55
Shortbread 64
Vanilla Wafers 77

Cereals
All Bran 38
Bran Chex 58
Bran Flakes 74
Cheerios 74
Complete 48
Corn Bran 75
Corn Chex 83
Corn Flakes 92
Cream of Wheat 66
Crispix 87
Froot Loops 69
Grapenuts 75
Grapenuts Flakes 80
Life 66
Muesli 60
NutriGrain 66
Oat bran raw 55
Oatmeal 1 min 66
Puffed Wheat 74
Puffed Rice 90
Raisin Bran 61
Rice Bran 19
Rice Chex 89
Rice Krispies 82
Shredded Wheat 67
Special K 54
Swiss Muesli 60
Team 82
Total 76

Breads
Bagel 72
Croissant 67
Doughnut, bread type 76
English muffin 77
Ezekiel Bread 45
French Baguette, white 95
Hamburger bun 61
Healthy Choice 7 Grain 55
Kaiser roll 73
Pita 57
Pumpernickel 49
Rye 64
Rye, dark 76
Rye, whole 50
Tortilla – corn 52
Tortilla – flour 73
White 72
Whole wheat 72
Waffles 76
Wonder Bread 73

Juices
Agave nector 11
Apple 41
Cranberry 52
Grapefruit 48
Orange 55
Pineapple 46

Fruit
Apple 38
Apricot, canned 64
Apricot, dried 30
Apricot jam 55
Banana 62
Banana, unripe 30
Cantaloupe 65
Cherries 22
Dates, dried 103
Figs 61
Fruit cocktail 55
Grapefruit 25
Grapes 43
Kiwi 52
Mango 55
Orange 43
Papaya 58
Peach 42
Pear 36
Pineapple 59
Plum 39
Raisins 64
Strawberries 40
Strawberry jam 51
Watermelon 72

Pasta
Brown rice pasta 92
Gnocchi 68
Linguine, durum 50
Macaroni 46
Macaroni & cheese 64
Spaghetti 40
Spag. prot. enrich. 28
Vermicelli 35
Vermicelli, rice 58

Vegetables
Avocado 0
Beets 64
Carrots 47
Celery 0
Corn, sweet, cooked 60
Peas,cooked 48
Potato, white russet, baked 85
Yam 37

Nuts
Almonds 0
Brazil Nuts 0
Cahews 22
Hazel Nuts 0
Macadamia Nuts 0
Pecan 0
Peanuts 20
Walnuts 0

Sweets
Fructose 19
Honey 58
Jelly beans 80
Life Savers 70
Mars Bar 68
M&M's Choc. Peanut 33
Milky Way Bar 44
Skittles 70
Snickers 68

Desserts
Angel Food Cake 67
Apple muffin 44
Banana bread 47
Blueberry muffin 59
Bran muffin 60
Danish 59
Fruit bread 47
Pound cake 54
Sponge cake 46

Crackers
Kavli Norwegian 71
Rice cakes 82
Rye 63
Saltine 72
Stoned wheat thins 67
Water crackers 78

Milk Products
Ice cream low fat 50
Ice cream 16% fat 37
Milk 34
Pudding 43
Soy milk 31
Yogurt 38
Ensure, vanilla 48

Misc
Cheese 0
Eggs 0
French Fries 75
Gatorade 89
Maple Syrup 68
Meats, All 0
Pancakes 67
Popcorn, microwave 55
Potato Chips 54
Pretzels 83
Sushi 52
Tortilla Chips 63

These numbers may not be identical to all Glycemic Index lists. Different scientific studies on the Glycemic Index of many foods may vary by up to 5 poir The impact a food will have on blood sugars depends on many other factors like ripeness, cooking time, fiber and fat content. The information in this handout should be used along with the advice from your personal physician, certified diabetic educators and nutritionists. Patients should advise their physician if they experience elevated blood sugars on a low glycemic index diet.

** Further information on the Glycemic Index can be found at:
Internet: www.glycemicindex.com (This site has a Glycemic Index calculator),
* American Diabetes Association Article *Dietary Carbohydrate (Amount and Type) in the Prevention and Management of Diabetes*. DIABETES CARE VOLUME 27, NUMBER 9, SEPTEMBER 2004

Books: The New Glucose Revolution: J. Brand-Miller, T. Wolever, S. Colagiuri, K. Foster-Powell, A. Leeds.
The Glucose Revolution- Pocket Guide To Diabetes: K.Foster-Powell, J. Brand-Miller, S. Colagiuri, T. Wolever