

CEC ARTICLE 4, 2010: Adult On-set Diabetes and Passing it to Your Offspring

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What is It?

Type 2 diabetes, adult onset diabetes, or non-insulin dependent diabetes is all names for the same disease. It is related to a metabolism disorder due to high blood sugar level in the body. This high sugar level is caused by insulin resistance, where the receptors cells of the human body do not react with the insulin produced by the beta cells responsible for secretion of insulin in the pancreas.

What are the Symptoms?

Type 2 diabetes is hard to recognize in early stages because the blood glucose levels rises very slowly and a person feels nothing is wrong with him. One third of people who have type 2 diabetes do not know recognize their symptoms. If mentioned symptoms appear to a person he/she needs to consult a doctor and start getting treated as early as possible.

The major symptoms are:

- Increase thirst
- Frequent urination
- Increase in appetite
- Unexplained weight loss
- Feeling weak and tired
- Getting cranky
- Slow wound healing
- Blurry vision
- Numbness in hands or feet
- Skin infections

How do you get it?

The major causes of type 2 diabetes are lifestyle and genetics. No or low physical activity, unbalanced diet, high alcohol and parents passing diabetes to children through genetic means.

Implications to Society?

Diabetes is 7th leading death causing disease in United States of America. Diabetes is one of the fast growing disease among grown ups and children. According to the Centers for Disease Control and Prevention, 1 in 10 Americans has diabetes, and one in three will have the disease by the year 2050.

This illness costs the health care system a staggering \$174 billion a year. However, what often gets overlooked, is how much the individual spends in treating diabetes. Even with insurance, people with Type 2 diabetes, often face substantial out-of-pocket expenses. The cost is part of the reason only 25 percent of diabetics get the care they need.

According to a recent report by Consumer Reports Health, diabetics spend an average of \$6,000/year on treatment. The figure includes monitoring supplies, medicines, doctor visits, annual eye exams and other routine costs. But the figure doesn't include the costs of medical complications (like heart disease, strokes, liver and kidney damage, eye damage and a susceptibility to infections and poor healing that can lead to amputations) resulting from Type 2 diabetes. Estimates are that diabetic patients on average pay twice as much as those without the illness for health care.

Cures?

But the good news, is it can be healed in natural ways. The suffering people of type 2 diabetes can cure the disease by maintaining their required sugar levels. 80 percent of Type 2 diabetes can be prevented with three steps that do not have to cost money: stopping smoking, eating a healthy diet and exercising regularly.

Having fruits and vegetables that are deep in colors such as yellow, orange, blue, purple and green. These dark fruits and vegetables are rich in nutrients like minerals, fiber, vitamins, which can promote better health, maintain blood sugar levels, and give sense of well being. Some of the important fruits and vegetables which help to control diabetes are apples, tomatoes, strawberries, guava, broccoli, cabbage, sweet potatoes, carrot, apricot, blue and blackberries, pineapples, oranges, pears, sprouts, beans, papaya and aborigines.

“Of course, that ‘says easy’ and ‘does hard’ for most people,” Dr. Loeppke acknowledged, “but so far, those are the best diabetes preventions out there.”

Society and Type 2 Diabetes in Children?

In a survey in China, 92 million people suffer from diabetes. Among them 5 percent are children. In the US the percentage is substantially higher. Type 2 diabetes, the obesity-related form in which the body does not respond to insulin normally, used to be seen predominately in adults. Children did not typically get Type 2 diabetes so, it was called adult-onset diabetes. With rising cases of childhood obesity, children are now getting Type 2 diabetes, and the numbers are increasing rapidly.

Most of the usually symptoms - Increase thirst, Frequent urination, Increase in appetite, Feeling weak and tired, Getting cranky, Slow wound healing, Blurry vision, Numbness in hands or feet, and Skin infections- also affect children. However, children and teens with Type 2 diabetes, insulin resistance, or obesity may also develop thick, dark, velvet-like skin around the neck, armpits, groin, between fingers and toes, or on

elbows and knees — a cosmetic skin condition called acanthosis nigricans.

If you think that your child might have adult-onset diabetes, it is important to seek medical care quickly. Diabetes is a chronic condition that if not properly treated or diagnosed can lead to poor cardiovascular health, strokes, amputations, kidney damage, and blindness.

Personal choices can contribute to a problem, and it's easy to blame people and children who have Type 2 for their problem. Remember that as with Type 1 diabetes, genetics seems to play a role in the development of Type 2. Not all overweight kids appear to be at risk of developing Type 2 diabetes. That's where genetic factors are important.

Studies have found much higher rates of Type 2 in Americans of African, Hispanic, Asian, and American Indian descent. Most children who develop Type 2 also have a close relative with the disease. Add that genetic factor to a fast food lifestyle that has resulted in twice as many kids who are seriously overweight now as in 1970, and you get an "epidemic" of Type 2 diabetes.

Parents and Type 2 Diabetes in Children?

Quoted and Paraphrased from Newsweek's Article – Sins of the Grandfathers

While researchers haven't come up with all of the answers yet, studies are pointing the finger at several contributing factors to Type 2: obesity (overweight), genetics, poor diet, lack of exercise, and even conditions in the womb before birth. Type 2 diabetes has started showing up at younger and younger ages. It has even been found in children as young as 4 years old! What's happening? Michael

Skinner - "We just published a paper last month confirming epigenetic changes in sperm which are carried forward trans-generationally. This confirms that these changes can become permanently programmed." In plain English - the life experiences and choices of grandparents and even great-grandparents alter their eggs and sperm so that the change is passed on to their children, grandchildren, and future descendants. It's called transgenerational epigenetic inheritance.

The astounding part of Skinner's statement is that this altered inheritance does not occur the way generations of biologists were taught. Instead of changing the DNA sequences that ancestors pass down to descendants, something more subtle occurs in epigenetic inheritance. Life experiences alter the on-off switches that control DNA in sperm or eggs. The switches can activate or deactivate the genes they attach to. (This switching is why the DNA for, insulin is turned off in brain cells but active in pancreas cells.) But biologists believed that when sperm and eggs were created in humans and then created an embryo, the switches were reset, in effect erasing the lifestyle choices of the fathers and mothers before they could affect the next generation.

Skinner's discovery that not all those switches are erased, but are instead **permanently** modified, has challenged reproductive biology. The results have caused resistance in the medical community to accept the findings even though Skinner's findings are not unique. Other labs, too, are finding that experiences—everything from a lab animal being exposed to a toxic chemical to a person smoking, being malnourished in childhood, or overeating—leaves an imprint on eggs or sperm, an imprint so tenacious that it affects not only those individuals' children but their grandchildren as well.

Skinner and his co-worker have showed how this works. By analyzing the on-off settings of switches on every bit of sperm DNA, they found that 16 had been altered. Those alterations appeared in the sons of mother rats exposed to the fungicide when they were pregnant. Then it appeared on the paternal line of the sons of the sons, and in the sons of the sons' sons. The tags on the sperm DNA did not vanish as currently taught. As a result, because some genes that were supposed to be dormant were active, and some genes that were supposed to be active were inactive, the sons and grandsons developed abnormalities in their testes, prostates, and kidneys. The point was not about the fungicide—but a proof that by altering sperm in an enduring way, an environmental exposure can leave its mark on at least four subsequent generations.

Scientists at Australia's University of New South Wales fed healthy, male rats a typical American high-fat diet (43 percent of calories from fat). As expected, the rats put on weight and fat, and developed insulin resistance and glucose intolerance—basically, **type 2 diabetes**. The scientists reported this in *Nature*. What was surprising was the daughters of these rats. Their mothers were of normal weight and ate a healthy diet while pregnant, but the daughters of the high-fat-diet dads developed insulin resistance and glucose resistance as adults—even though they never ate a high-fat diet themselves.

It was believed that a mothers' diet while pregnant affects their children's health as adults because of how nutrients and toxic compounds pass through the placenta. However it was also believed that fathers have no contact with their daughters except through the sperm that created them and could not pass on society induced diseases. These rat fathers were not genetically diabetic and therefore, the conclusion is the fathers' high-fat diet altered their sperm in a way that induced adult-onset disease in their daughters.

Emma Whitelaw of Queensland Institute of Medical Research, who has found similar transgenerational effects, has called it “a molecular memory of the

parent's experience—in this case, diet.” Like Skinner's finding that sons and grandsons of his affected rats had abnormal on-off switches in their sperm DNA, the Australian team found that 642 genes in the pancreas (which makes insulin) of the daughters of the high-fat-diet fathers had on-off switches in the wrong position. The result raises the possibility that the childhood-obesity epidemic is partly due to alterations in sperm caused by fathers-to-be eating a high-fat diet. After all, how can you blame it on kids' inactivity and junk food, when the obesity in babies has risen 73 percent since 1980.

In 2006 scientists announced the findings that if a father began smoking before the age of 11, his sons had a greater body-mass index than did sons of men who took up smoking as adults. In this same population, if a man suffered food shortages as an 8- to 12-year-old child, his sons' sons were more likely to die young; if a woman suffered food shortages as a child, her son's daughters were more likely to die young. Another study, found that if a man overate in childhood, his sons' children were four times more likely to develop diabetes and cardiovascular disease. So if life experiences leave indelible marks on the sperm or eggs that are passed to children and grandchildren, consider it a warning to hold off on your unhealthy behavior until after you have kids.

<http://www.newsweek.com/2010/10/30/how-your-experiences-change-your-sperm-and-eggs.html>

Treatment with Children?

The initial treatment typically used in children is insulin shots because Type 2 diabetes is often more severe in children than it is in adults. Occasionally, medications taken by mouth can be used which help the insulin work better if the diabetes is caught early. All treatments are aimed at promoting excellent blood sugar control.

Since exercise and weight loss both help insulin to work better and thus to control blood sugars better, both exercise and weight loss can in essence 'cure' diabetes in some patients. However, type 2 diabetes will always return with weight gain and with reduction in exercise.

A child or teenager with Type 2 diabetes must:

eat a healthy diet to control body weight while getting the nutrients needed to grow and develop properly,

eat a low-salt/low-fat diet to control high blood pressure or abnormal blood fat levels,

get physical activity to increase the body's response to insulin, to help the body burn more calories, and to promote the loss of excess body fat,

get to and maintain a normal body weight.

monitor blood sugar levels regularly,

take insulin or other medications which help the body respond to insulin more effectively, and

work closely with their doctors and diabetes health care team to help achieve the best possible control of their diabetes and be monitored for signs of diabetes complications and other health problems that occur more frequently in children with Type 2 diabetes.

In the end, all kids with diabetes—Type 1 and Type 2—will benefit from working together to cure the disease. One reason is that both types of diabetes can cause the same long-term complications. Also, by looking at the causes of both diseases, and treatment options, there may be common lessons to be learned for the children and their parents.

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1. What is Type 2 Diabetes?
2. What organ is responsible for producing insulin?
3. T/F It is easy to recognize the early symptoms of Type 2 Diabetes.
4. List the 10 symptoms of Type 2 Diabetes.
5. What are the 2 causes of Type 2 Diabetes?
6. How many Americans have diabetes now and how many will have it by 2050?
7. How much does it cost the health care system per year?

8. How much does it cost an individual even with health insurance?
9. What are some lifestyle choices that contribute to diabetes?
10. What are some lifestyle choices three steps that no cost that help control diabetes?
11. What are some fruits and vegetables that help control diabetes naturally?
12. Why do fruits and vegetable help control diabetes?
13. What percentage of diabetics are children in China?
14. What is a symptom of diabetes that children and teens may get that is not common in adults?
15. T/F Type 1 diabetes can play a role in the development of Type II diabetes.
16. What are the health problems uncontrolled diabetes can lead to?
17. Which genetic backgrounds have a higher incidence of childhood Type II diabetes?

18. Genetics and the fast food lifestyle have done what to the number of overweight kids since 1970?

19. Up until recently what were the commonly believed contributors to diabetes from lifestyle and genetics?

20. What is the new information coming about that has the medical community in an uproar about diabetes and DNA?

21. Although the mechanism was worked out for rats, how many human research studies reported in this article supported the hypothesis of Skinner?

22. Where any of them (human or rats) looking at diet specifically and what did they find?

23. What other lifestyle changes were studied that had ramifications on future generations?

24. T/F Type 2 diabetes has the same risks and treatments in children as in adults.

25. What is the treatment protocol for children with Type 2 Diabetes?