

## Seven facts you may not know about

## EXERCISE

BY DAVID SCHARDT

Everybody knows that aerobic exercise builds endurance and strengthens the heart, and that strength training builds muscles. But did you know that exercise creates new brain cells? Or that it can help ward off cancer and diabetes? Or that it can keep you from accumulating the wrong kind of body fat?

Here are seven facts about exercise that may surprise you.

## 1. Exercise Can Curb Your Risk of Cancer

“Physical activity is central to reducing your risk of cancer,” says physician Michael Thun, vice president emeritus for epidemiology and surveillance at the American Cancer Society.

“There are two ways that regular exercise can potentially do that,” he explains. It can indirectly lower your risk by keeping off excess weight, or it can work directly on cancer risk.

“With respect to colon cancer, the direct effect is very well documented. Studies show that even light to moderate regular activity is associated with lower risk compared with inactivity.”

Earlier this year, researchers at the Washington University School of Medicine in St. Louis, Missouri, reviewed 52 studies of exercise and colon cancer. The most active people were about 21 per cent less likely to be diagnosed than their least active counterparts.<sup>1</sup>

Researchers aren’t sure how activity may protect the colon. “Bowel motility is one possible mechanism,” says Thun. “Just moving things through the bowel is better than having them sit there.” But, he cautions, “it’s much easier to propose mechanisms than to prove them.”

In contrast, it may take more than brisk walking or other moderate activity to lower the risk of breast cancer. “With colon cancer, just not being sedentary is a good thing,” says Thun. “With breast cancer, there’s fairly consistent evidence



**Brisk walking seems to reduce the risk of colon cancer, but it may take more vigorous exercise to protect against breast cancer.**

that the reduced risk occurs only with greater, moderate-to-vigorous activity.”

And it may never be too late to start.

Researchers tracked some 119,000 women in their 50s and 60s for seven years in the U.S. NIH-AARP Diet and Health Study. Those who reported more than an hour a day of moderate-to-vigorous activity—even if they hadn’t exercised earlier in their lives—were 16 per cent less likely to be diagnosed with breast cancer than those who rarely did moderate-to-vigorous exercise.<sup>2</sup>

“It looks like women who are more aerobically fit are less likely to die of

breast cancer,” says Steven Blair, an exercise epidemiologist at the University of South Carolina.

Again, researchers aren’t sure why. One possibility: “Physical activity reduces the exposure of tissues to insulin-like growth factor,” notes Thun. If IGF promotes cancer, having less available in the bloodstream may help.

Exercise may also indirectly prevent cancer by keeping the pounds off. While “the direct effects of exercise are most clearly on large bowel and breast cancer,” says Thun, the impact of weight gain is broader.

“Weight gain is associated with quite a few cancers, notably post-menopausal breast cancer, colorectal cancer, endometrial cancer, pancreatic cancer, and adenocarcinoma of the lower esophagus,” he notes.

“And the list isn’t complete yet because there is accumulating evidence that obesity is a risk factor for several of the blood-forming cancers like leukemia and lymphoma.”

That’s why the American Cancer Society now recommends at least 30 minutes of moderate-to-vigorous physical activity at least five days a week, but says that 45 to 60 minutes is preferable.<sup>3</sup>

“Just how much exercise is enough and how large is the benefit are still gray areas,” says Thun. “But the overwhelming reality is that most North Americans are too sedentary, and the issue is not what the perfect amount is, but how we can all increase the amount we’re getting.”

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## 2. Exercise Creates New Brain Cells

“We know that older adults on average perform slower and less accurately on cognitive tests than younger people,” says Charles Hillman, director of the Neurocognitive Kinesiology Laboratory at the University of Illinois at Urbana-Champaign.

“But what we also see is that older individuals who are more fit perform better to the point where they’re sometimes no different from young adults.”

Hillman and his co-workers asked 240 people between the ages of 15 and 71 to quickly pick out the direction of an arrow that was embedded among distracting elements.<sup>4</sup> “The older adults were generally slower,” he notes. “But the more days a week they exercised, the faster their reaction time and the more accurate their responses.”

How does exercise boost your brain?

In laboratory animals, it increases blood flow to the brain and stimulates the growth of new brain cells, new connections or synapses between cells, and new capillaries to distribute the blood and its nutrients.

In a 2006 study by University of Illinois researchers, 30 healthy but sedentary men and women aged 60 to 79 were put on an aerobic exercise training program. After six months, their brain volume—the amount of grey and white matter—had increased.<sup>5</sup> That meant more brain cells and more connections between them. Brain volume didn’t increase in 30 similar people who participated in a toning and stretching program.

“Aerobic exercise increases the supply of a protein called brain-derived neurotrophic factor, or BDNF, which protects brain neurons and promotes the growth of new nerve cells and synapses that are related to learning and memory,” says Hillman.

BDNF is active in the hippocampus, an area deep in the brain that is essential for memory, especially for what’s called relational memory. That’s the ability to make logical connections among pieces of information and to navigate in space. The hippocampus tends to shrink as people age, and it’s one of the first parts of the brain to be damaged in Alzheimer’s disease.



### Hippocampus

Aerobic exercise may increase the size of the hippocampus, an area deep in the brain that’s critical for memory.

In rats and mice, aerobic exercise increases the size of the hippocampus and improves spatial memory. The same appears to be true for older humans.

Hillman’s colleagues recruited 165 healthy men and women between the ages of 59 and 81 and measured how long they could last on a treadmill. The more fit they were, the larger their hippocampus was on an MRI (magnetic resonance imaging) scan, and the better they did on a test for spatial memory.<sup>6</sup>

Impaired spatial memory—having trouble finding your way or knowing what goes where—is a major reason older people lose their independence, points out one of the Illinois researchers, Art Kramer. “This study shows that there’s a significant and substantial relationship between how fit you are and how good a kind of memory is that we need all the time,” he notes.

Aerobic exercise also appears to boost executive function. That’s the ability to plan or make decisions, correct errors, or react to new situations.

In 2004, Kramer and his colleagues put 29 healthy adults aged 58 to 77 on either an aerobic walking or a stretching program three times a week. After six months, the walkers performed better on a test of executive function.<sup>7</sup>

“We know now that you *can* teach an old dog new tricks,” says Hillman. “Older brains can grow nerve cells, too.”

Strength training like weightlifting helps build muscles and strengthen bones, but it’s not yet clear whether it affects the brain to the same degree as aerobic exercise, he notes.

## 3. Exercise Boosts Insulin Sensitivity

“One of the most consistent effects of both aerobic and strength training is that they improve insulin sensitivity,” says Ben Hurley, a professor and exercise physiologist in the Department of Kinesiology at the University of Maryland in College Park. (Hurley is married to *Nutrition Action’s* Jayne Hurley.)

Insulin is a hormone that allows blood sugar to enter the body’s cells, where it’s stored or used as fuel. However, as we age or when we put on weight, our bodies don’t respond as well to insulin and can become insensitive, or resistant, to the hormone. Insulin resistance increases the risk of heart disease and, if blood sugar levels keep rising, type 2 diabetes.

“There are dozens of studies showing that when people do aerobic exercise training, their insulin sensitivity improves within a very short time,” says Hurley. “We and

others have now shown that strength training can also improve insulin sensitivity by 20 per cent within a matter of months.”

For example, researchers at the University of Maryland in Baltimore put nine overweight or obese men in their 60s on a program of treadmill walking or jogging and 13 similar men on a strength-training program. After working out three times a week for six months, the aerobic exercisers increased their cardiorespiratory fitness by 16 per cent, the resistance exercisers increased their arm and leg muscle strength by 45 per cent,

## You Call That Intense?

**MODERATE-INTENSITY EXERCISE.** It noticeably increases your heart rate and breathing rate. You may sweat. You can talk but you can’t sing.

**Examples:** ballroom or line dancing, biking on relatively level ground, canoeing, doubles tennis, sports where you catch and throw (baseball, volleyball), walking briskly, water aerobics.

**VIGOROUS EXERCISE.** Your heart is beating noticeably faster and you’re probably sweating. You can only say a few words before you have to catch your breath.

**Examples:** aerobic or fast dancing, biking more than 16 km/h, hiking uphill, hockey, jogging, jumping rope, martial arts (karate, etc.), race walking, running, singles tennis, sports with a lot of running (basketball, soccer), swimming fast or swimming laps.

Source: [www.health.gov/paguidelines/committeereport.aspx](http://www.health.gov/paguidelines/committeereport.aspx).

and both groups improved their insulin sensitivity by 20 to 25 per cent.<sup>8</sup>

"The average physician who deals with insulin resistance and diabetes recognizes that aerobic training is helpful, so they'll prescribe it," says Hurley. "But hardly anyone will prescribe strength training, even though it works just as well if done properly."

Contrary to what many people believe, says Hurley, the reason strength training is effective isn't because it builds muscle mass.

"Both aerobic exercise and strength training increase the number of proteins called glucose transporters—particularly GLUT4—which move glucose from the blood into muscle and fat cells," he notes.

The more GLUT4 you have, the better your cells respond to insulin. "The effect seems to last at least 24 hours, if not 48 hours," says Hurley. "That's long enough if you exercise at least every other day."

## 4. Creatine Helps Build Muscle

"Weight or resistance training by itself strengthens muscles and bone," says researcher Darren Candow of the Faculty of Kinesiology and Health Studies at the University of Regina in Saskatchewan. "But there's a safe and easy way to increase the benefits even more."

Candow is referring to creatine, a compound that makes energy available to muscles during times of high demand. The liver and kidneys make about two grams of creatine every day from three amino acids (glycine, methionine, and arginine) that are in the protein we eat. But creatine is also sold over the counter as a powder and in pills.

"We've known for some time that athletes and bodybuilders become stronger after taking supplemental creatine, and now we know that older men and women can benefit too," says Candow.

In one study, for example, 30 men around age 70 did strength training exercises three days a week. After 12 weeks, those who were given roughly 5 grams of creatine a day put on double the muscle and could lift 40 to 60 per cent more weight with their legs (but not their arms) than those who were given a placebo.<sup>9</sup>

How does creatine work? "It's a high-energy compound, so if you have more of it in your muscle, you can lift heavier weights more intensely and longer," says



**No matter your age, you can build muscle strength in just a few weeks.**

Candow. Creatine also seems to turn on muscle-building genes, which direct muscle proteins to grow, he adds.<sup>10</sup>

What's more, creatine stimulates satellite cells, which are stem cells found in muscle.<sup>11</sup> Satellite cells help form new muscle fibres after muscles have been damaged by injury, disease, or even weightlifting.

And creatine helps prevent proteins from breaking down, which can help preserve bone.<sup>12</sup>

Creatine works in both men and women, says Candow, "although many women don't like the fact that in the beginning it leads to water retention and increased body weight." (Men may think they're just bulking up.) "But what we're now seeing is that older women could care less because they'd rather have their bones and muscles get stronger."

Taking creatine seems to work better in vegetarians, who don't get as much from their food and have lower levels in their muscles.<sup>13</sup> People who eat red meat or seafood more than once a day, notes Candow, may see less impact on their muscles.

If you want to try creatine, says Candow, take one gram for every 20 pounds you weigh, half before a strength-training session and half after. So a 160-pound person would need 8 grams of creatine on exercise days. Cost: about 50 cents per session.

For an extra boost, says Candow, combine the creatine with 20 to 25 grams of protein.

In one of his recent studies, men aged 59 to 77 who did strength training and took creatine with protein three times a week for 10 weeks put on more muscle and could lift more weight than men who took creatine alone.<sup>12</sup> (The study was

funded by the Canadian government and a protein powder manufacturer.)

Candow suggests mixing two cups of skim milk with creatine and drinking half before a workout and half after.

As for side effects, "there's sometimes loose stools or a little bit of cramping at the onset when someone takes too much," says Candow. "And creatine makes the liver and kidneys work harder. But if you're healthy that's not a problem." If you have cirrhosis or kidney problems, check with your doctor before taking creatine.

You're best off with pure creatine powder or pills, says Candow. "We've studied only 100 per cent creatine. Some companies combine creatine with up to 20 different ingredients. We don't know how healthy the other ingredients are."

## 5. Sitting Can Kill You

"People who sit for the majority of their day have much higher mortality rates than people who don't, even if they're



**Occasional bouts of exercise can't undo the harm from extended periods of sitting.**

physically active during another part of the day," says Peter Katzmarzyk, an epidemiologist at the Pennington Biomedical Research Center in Baton Rouge, Louisiana.

"We've known for a while that people who watch a lot of television are more likely to be obese and have the metabolic syndrome," he notes. (The metabolic syndrome, which increases the risk of heart disease and diabetes, is a constellation of risk factors that includes a large waist and elevated—but not high—blood pressure, blood sugar, and blood triglycerides.)

"We've now shown for the first time that sitting is directly related to mortality."

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Katzmarzyk and his colleagues tracked a representative sample of 17,000 Canadian adults who took part in a 1981 national Fitness Survey. Nearly half reported sitting for at least half of their waking hours.<sup>14</sup>

After 12 years, roughly 20 per cent of those who had said they sat “almost all of the time” had died, compared with 12 per cent of those who sat “approximately half the time” and just 6 per cent of those who sat “almost none of the time.” And that was true of non-smokers as well as smokers, and the lean as well as the overweight or obese.

“Long periods of sitting cannot be compensated for with occasional leisure time physical activity,” says Katzmarzyk. “If you’re active for just 30 minutes a day, how is that supposed to wipe out all the other hours of sitting?”

What’s so bad about sitting?

“Muscles seem to be extremely inactive while sitting, and this may change the way they metabolize compounds and may affect the regulation of insulin and glucose,” says Katzmarzyk. “Just getting people to stand up changes the physiology in their limbs.”

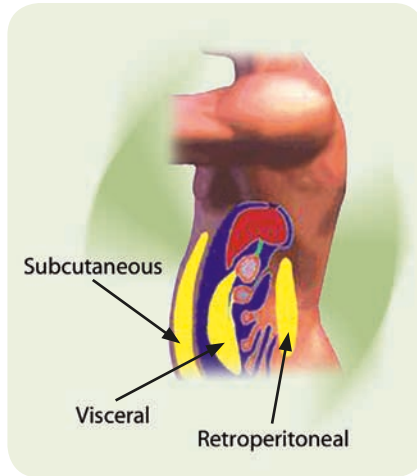
His advice: “Stand up, walk around, do anything like that to encourage blood flow and increase the muscle activity in the lower limbs. Two of my colleagues here have treadmill desks, or they stand during meetings, or they’ll take a meeting outside and walk rather than sit.”

## 6. You’re Never Too Old to Build Muscle

“Dozens of studies have documented that you can build up your muscles and increase your strength with resistance or weight training no matter how old you are,” says University of Maryland exercise physiologist Ben Hurley.

“In fact, the oldest person we know of who did this was 103 years old.”

Hurley and his colleagues had 23 healthy men and women aged 65 to 75 do knee extension exercises three times a week on one of their legs. Even though the study wasn’t designed to maximize strength gain, after nine weeks the muscle volume in that leg increased by 12 per cent and the leg could lift 28 per cent more weight than the unexercised leg.<sup>15</sup>



**Aerobic exercise can help reduce visceral fat, which is linked to insulin resistance, heart disease, and diabetes.**

“The magnitude of these increases is often even greater in older people than it is in younger people because they typically start at a lower level,” says Hurley. “You can really see the difference.”

While middle-aged and older people who do strength training regularly won’t look like buff 20-year-olds, he adds, “they will certainly look stronger and more muscular than the average person their age.”

Women needn’t worry that they’ll wind up looking like muscle men, says Hurley.

“We’ve studied that. And we find that women increase their muscle mass only about half as much as men. But the interesting thing is that with weight training, women improve their strength just as much as the men do.”

That’s because women improve their muscle *quality*—the amount of force they can exert per muscle unit—more than men do when they train.<sup>16</sup>

In fact, says Hurley, women may like looking slightly more muscular as they get older. “Our skin tends to become loose as we age, so putting on some muscle underneath will make the skin look tighter and younger.”

How often do you need to build muscle? Three times a week, basically every other day, says Hurley. But your strength—the maximum force you can produce—improves quickly, sometimes after just one workout.

“Building muscle takes a little longer,” notes Hurley. Even so, “it often becomes noticeable in as little as four weeks.”

## 7. Exercise Prevents Visceral Fat Gain

“All of us gain visceral fat as we get older unless we do something about it,” says Cris Slentz, an exercise physiologist at the Duke University Medical Center in Durham, North Carolina.

Visceral fat, which accumulates around the organs deep inside the belly, is linked to insulin resistance, heart disease, and diabetes. Subcutaneous fat, which lies closer to the skin, is not as harmful.

If a man has a big belly, the odds are that he has a fair amount of visceral fat. A woman, on the other hand, can have quite a big belly and still not have much, says Slentz.

In 2005, Slentz and his colleagues reported that sedentary overweight men and women who followed an exercise program equivalent to a brisk 30-minute walk six times a week for eight months stopped gaining visceral fat. “And if they did more exercise, the equivalent of jogging 32 kilometres, a week,” he says, “they actually lost 7 per cent of their abdominal fat.”

But the real shocker was the people in the control group, who were not told to step up their exercise. After just six months, their visceral fat stores *increased* by 9 per cent.<sup>17</sup>

“We know how to slow this increase down and even stop it,” says Slentz. “Many studies have shown that aerobic exercise will reduce visceral fat as long as you keep on doing it.”

Dieting can also help you lose visceral fat, he adds. “But most of this reverts back to normal within a year because people quit dieting and go back to what they were doing before.”

<sup>1</sup> *Br. J. Cancer* 100: 611, 2009.

<sup>2</sup> *BMC Cancer* 9: 349, 2009.

<sup>3</sup> *CA* 56: 249, 2006.

<sup>4</sup> *Health Psychol.* 25: 678, 2006.

<sup>5</sup> *J. Gerontol. A Biol. Sci. Med. Sci.* 61: 1166, 2006.

<sup>6</sup> *Hippocampus* 19: 1030, 2009.

<sup>7</sup> *Proc. Natl. Acad. Sci. USA* 101: 3316, 2004.

<sup>8</sup> *J. Gerontol. A Biol. Sci. Med. Sci.* 61: 480, 2006.

<sup>9</sup> *Med. Sci. Sports Exerc.* 33: 2111, 2001.

<sup>10</sup> *Physiol. Genomics* 32: 219, 2008.

<sup>11</sup> *Appl. Physiol. Nutr. Metab.* 33: 213, 2008.

<sup>12</sup> *Med. Sci. Sports Exerc.* 40: 1645, 2008.

<sup>13</sup> *Med. Sci. Sports Exerc.* 35: 1946, 2003.

<sup>14</sup> *Med. Sci. Sports Exerc.* 41: 998, 2009.

<sup>15</sup> *J. Appl. Physiol.* 86: 195, 1999.

<sup>16</sup> *J. Appl. Physiol.* 99: 1712, 2005.

<sup>17</sup> *J. Appl. Physiol.* 99: 1613, 2005.

# Nine Other Reasons to Exercise

BY BONNIE LIEBMAN

Looking for some motivation to leave the computer, TV, or dining room table? Here's a handful of reasons. For more, check out the Public Health Agency of Canada ([www.phac-aspc.gc.ca/pau-uap/fitness/evidence.html](http://www.phac-aspc.gc.ca/pau-uap/fitness/evidence.html)) and the U.S. government's Physical Activity Guidelines ([www.health.gov/paguidelines](http://www.health.gov/paguidelines)).

## Stroke

Aerobic exercise lowers the risk of stroke.<sup>1</sup> In one study, women who walked at least an hour a day had a 40 per cent lower risk than those who walked less than an hour a week.<sup>2</sup>

## Heart Disease

Aerobic exercise cuts the risk of heart attack by 20 to 35 per cent in most studies.<sup>1</sup> In one study of 73,000 women, those who walked briskly for 30 minutes a day, five days a week, had a 30 to 40 per cent lower risk of a heart attack or other cardiovascular event than sedentary women.<sup>3</sup>

## Broken Bones

Weight-bearing aerobic and strength-training exercise three to five days a week can increase—or slow the decrease in—the density of spine and hip bones.<sup>1</sup> In one study, women who walked at least four hours a week were 40 per cent less likely to break a hip than those who walked less than an hour a week.<sup>4</sup>

## Diabetes

Moderately active people have a 30 to 40 per cent lower risk of type 2 diabetes and the metabolic syndrome than inactive people.<sup>1</sup> In one study, normal-weight women who were sedentary had twice the risk of diabetes, and obese women who were sedentary had 16 times the risk of diabetes, compared to normal-weight active women.<sup>5</sup>

## Depression

Active people are 15 to 25 per cent less likely to be diagnosed with depression than inactive people. In people with depression, moderate-to-vigorous aerobic exercise (30 minutes three times a week) improves symptoms.<sup>1</sup>

## Blood Pressure

Forty minutes of moderate-to-vigorous aerobic exercise three to five times a week lowers systolic blood pressure by 2 to 5 points. That may not sound like much, but it would save thousands of lives per year.<sup>1</sup>

## Mitochondria

Aerobic exercise increases the size, number, and activity of mitochondria, the fuel-burning centres of your muscle cells.<sup>6</sup> (Mitochondria don't function as well in people who are older, obese, or diabetic.)

## Arthritis

If you have arthritis, moderate-intensity, low-impact exercise for 30 to 60 minutes three to five times a week can reduce pain and disability. Both aerobic and muscle strengthening help.<sup>1</sup>

## Falls

Older adults who are physically active have about a 30 per cent lower risk of falls. In most studies, people participate in balance and moderate-intensity strength training for 30 minutes three times a week and are encouraged to walk for 30 minutes at least twice a week. Tai chi may also work.<sup>1</sup>

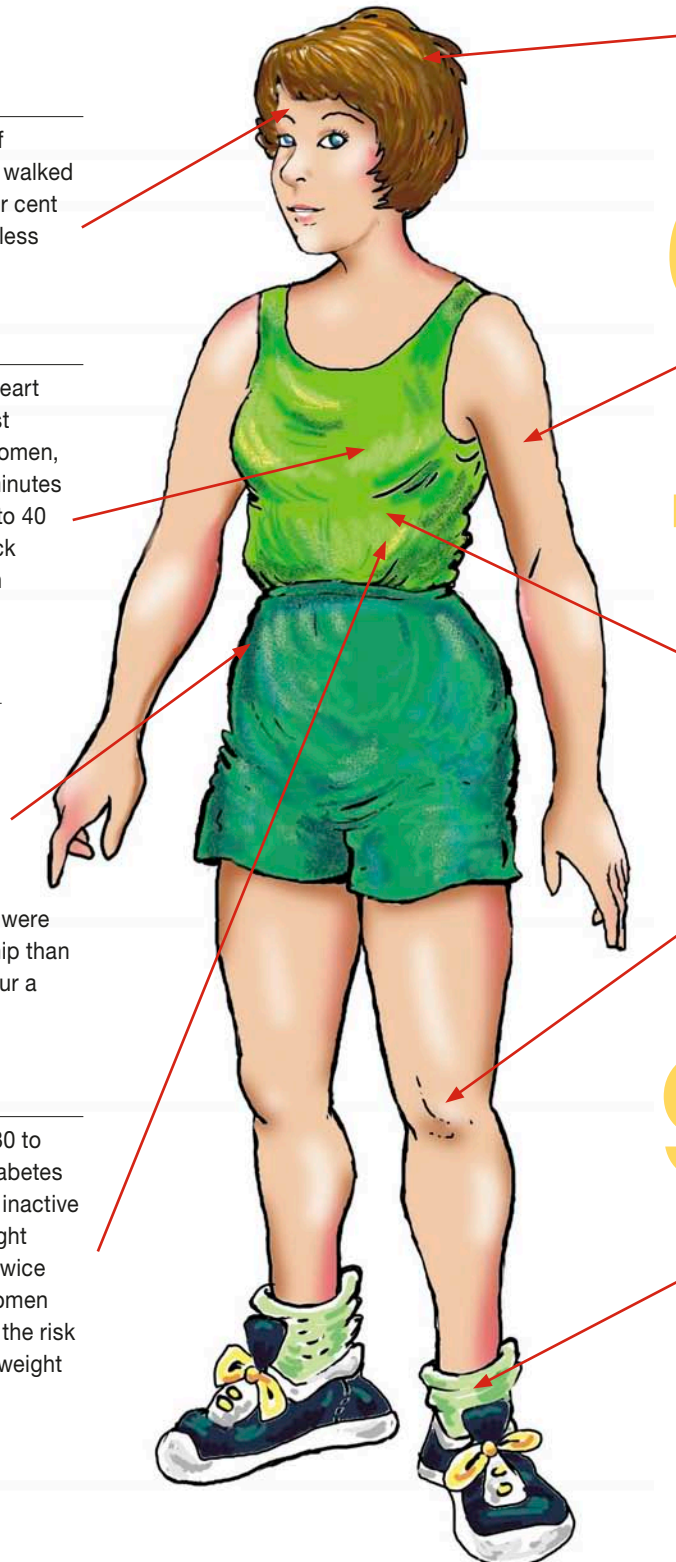


Illustration: Loel Barr.

<sup>1</sup> [www.health.gov/paguidelines](http://www.health.gov/paguidelines).

<sup>2</sup> *JAMA* 283: 2961, 2000.

<sup>3</sup> *N. Engl. J. Med.* 347: 716, 2002.

<sup>4</sup> *JAMA* 288: 2300, 2002.

<sup>5</sup> *Diabetes Care* 30: 53, 2007.

<sup>6</sup> *Am. J. Clin. Nutr.* 89 (suppl): 453S, 2009.