Type I and Type II Errors - Making Mistakes in the Justice System

Even though how questions in America can be asked if they really are prevented questions, why a defendant is found not guilty instead of innocent, or why Americans put up with a justice system which routinely allows criminals to go free on technicalities? These questions can be understood by understanding the similarity of the American justice system to hypothesis testing in statistics and the two types of errors it can produce. This discussion assumes that the reader has at least been introduced to the normal distribution and its use in hypothesis testing. Also please note that the American justice system is used for concreteness.

Often people are cited as examples such as the British system which inspired the American system.

From the trial process does not mean reversal values as does hypothesis testing in statistics, but both the justice system and statistical versions of hypothesis testing share at least three common elements (other than a lot of jargon that sounds like double talk):

1. The alternative hypothesis - This is the one the lawyer is trying to prove. Obviously the police don’t think the accused person is innocent or they wouldn’t waste time. In statistics the alternative hypothesis is the hypothesis the researcher wishes to evaluate.
2. The null hypothesis - in the criminal justice system this is the presumption of innocence. In both the judicial system and statistics the null hypothesis indicates that the suspect or treatment didn’t do anything. The null is the logical opposite of the alternative hypothesis. For example “the suspect is innocent” is the logical opposite of “the suspect is guilty”. Color in red, blue and green as well as black at quick as “not white”.
3. A standard of judgment - in the justice system and statistics there are no possibility of clear-cut yes and no standard has to be set in the rejection of the null hypothesis. In the justice system the standard is “beyond a reasonable doubt”. The null hypothesis has to be rejected beyond a reasonable doubt. In statistics the standard is the maximum acceptable probability that the effect is due to random variability in the data rather than the cause being investigated. This standard is often set at 5% which is called the alpha level.

It only takes some good pieces of evidence to send a hypothesis to infinity, but an existence proof to prove it. If the null is rejected then logically the alternative hypothesis is accepted. This is why both the justice system and statistics concentrate on disproving or proving the null hypothesis rather than proving the alternative. It’s much easier to do. If a jury rejects the presumption of innocence, the defendant is pronounced guilty.

Unfortunately, unlike the legal system or statistical testing are perfect. A jury sometimes makes a more and an innocent person goes to jail. Statisticians, being highly imaginative, call this a type I error. Citizens call it a travesty.

If the null hypothesis is false, the defendant is innocent, but the convincing evidence is not sufficient. This makes it possible that the defendant may be innocent and not be convicted. Statisticians have given this error the highly imaginative name, type II error.

In the justice system, failure to reject the presumption of innocence gives the defendant a not guilty verdict. This means only that the standard of proving innocence was not met. It does not mean the person really is innocent. This would take an endless amount of evidence to actually prove the null hypothesis of innocence.

Sometimes, guilty people go free. Statisticians have given this error the highly imaginative name, type II error.

Americans find type II errors disturbing but not as horrifying as type I errors. A type I error means that not only has an innocent person been sent to jail but the guilty person has also gone free. In a sense, a type I error is twice as bad as a type II error.

Needless to say, the American justice system puts a lot of emphasis on avoiding type I errors. This emphasizes on avoiding type I errors, however, is not true in all cases: when hypothesis testing is done.

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Justice System - Trial

<table>
<thead>
<tr>
<th>Defendant</th>
<th>Type I Error</th>
<th>Type II Error</th>
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<tbody>
<tr>
<td>Innocent</td>
<td>Reject</td>
<td>Correct</td>
</tr>
<tr>
<td>Guilty</td>
<td>Fail to Reject</td>
<td>Correct</td>
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Statistics - Hypothesis Test

<table>
<thead>
<tr>
<th>Null Hypothesis</th>
<th>Type I Error</th>
<th>Type II Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>True</td>
<td>Reject</td>
<td>Fail to Reject</td>
</tr>
<tr>
<td>False</td>
<td>Correct</td>
<td>Correct</td>
</tr>
</tbody>
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It would be nice to completely eliminate both type errors but it can’t be done. In fact, reducing one causes the other to become higher. This happens because the appearance of guilt and innocence are not clear cut. Innocent people can appear to be guilty and guilty people appear to be innocent.

The normal distribution as shown in figure 1 can be used to represent the variability in the appearance of guilt for the population of innocent suspects. In a homicide investigation, for example, just about anyone who is a friend, relative, associate, or was in the immediate vicinity of the victim is initially considered a suspect.

People represented by the red area are considered "usual suspects", innocent people who appear guilty. People represented by the left hand tail are considered "unusual suspects", guilty people who appear innocent. If the standard of judgment were positioned as shown in figure 1, then all the innocent people represented by the red area would be judged guilty if they were unlucky enough to be assumed and tried for the crime (type I error). Those of the right hand tail, on the other hand, guilty people who appear innocent, would never be zero even if the standard of judgment were moved to the right. The only way to prevent all type I errors would be to arrest no one, which is called the alpha level.

The diagram shows what happens not only to innocent suspects but also guilty ones when they are arrested and tried for crimes. In this case, the criminals are usually guilty and have certain characteristics of arrested.

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Figure 1, Possible Suspects Who Are Innocent

<table>
<thead>
<tr>
<th>Not Guilty Juvenile</th>
<th>Guilty Juvenile</th>
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<tbody>
<tr>
<td>Apperance of Guilt</td>
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Figure 2, Innocent Suspects Who Are Arrested and Tried for a Crime

<table>
<thead>
<tr>
<th>Not Guilty Juvenile</th>
<th>Guilty Juvenile</th>
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<tr>
<td>Apperance of Guilt</td>
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Sunday Assembly Begins under Clear Blue Skies

The Virtual Tocetence

Figure 3, Appearance of Guilt
Figure 3. What Happens to Innocent Suspects or Clearly Guilty Criminals if They Are Arrested and Tried

If the police bungle the investigation and arrest an innocent suspect, there is still a chance that the innocent person could go to jail. Also, since the normal distribution extends to infinity in both positive and negative directions there is a very slight chance that a guilty person could be found on the left hand side of the standard of judgment. This means he would incorrectly be set free.

Unfortunately, justice is often not as straightforward as illustrated in Figure 3. Figure 4 shows the more typical case in which the real criminals are not as clearly guilty. Notice that the means of the two distributions are much closer together. As before, if bungling police officers arrest an innocent suspect there's a small chance that the wrong person will be convicted. However, there is now also a significant chance that a guilty person will be set free. This is represented by the yellow/green area under the curve on the left and is a type II error.

If the standard of judgment is moved to the left by making it less strict the number of type II errors or criminals going free will be reduced. This could be done by throwing out the reasonable doubt standard and instructing the jury to find the defendant guilty if they think it's possible that she did the crime. However, this would make the type I error unacceptably high. While fixing the justice system by moving the standard of judgment has great appeal in the end there is no free lunch.

The need for unbiased, highly trained, top quality police investigators with state of the art equipment should be obvious. There is no possibility of having a type I error if the police never arrest the wrong person. Improving the accuracy of police investigations is expensive and complex but achievable in today’s world with tools such as DNA testing. The famous trial of O. J. Simpson would either have ended in a guilty verdict or not have occurred at all if the Los Angeles Police officers investigating the crime had been beyond reproach.

Figure 4. What Happens to Innocent Suspects or Not So Clearly Guilty Criminals if They Are Arrested and Tried

The applet below can alter both the standard of judgment and distance between means for a statistical hypothesis test. It calculates type I and type II errors when you move the sliders. Like any analysis of this type it assumes that the distribution for the null hypothesis is the same shape as the distribution of the alternative hypothesis.

Note, that the horizontal axis is set up with a z-score scale. Z-scores indicate how many standard deviations a value is away from the mean. Zero represents the mean. For example, a z-score of 3 indicates that the value is 3 standard deviations above the mean. A z-score of -3 would be 3 standard deviations below the mean.

Try adjusting both the standard of judgment (the dashed red line) and the position of the distribution for the alternative hypothesis and you will develop a feeling for how they interact. Note that a type I error is often called alpha and is equal to the p-value. The type II error is often called beta. The power of the test = 1 - beta.
In studies, tea drinking has been shown effective in lowering high cholesterol and in cancer prevention. But researchers are still trying to figure out how. Likely, it is because the polyphenols in tea are strong antioxidants capable of "mopping up" DNA-damaging free radicals in the bloodstream.

Two studies in this month's *Journal of Nutrition* look at tea's health effects -- finding evidence that tea works, although exactly how is still a mystery.

The studies were presented at the Third International Scientific Symposium on Tea and Human Health, held today in New York City.

### Black Tea and High Cholesterol

One study looks at the effects of black tea on total and LDL "bad" cholesterol in adults who had mildly high cholesterol levels. Each was on a carefully controlled diet; each was asked to drink five servings of black tea daily for three weeks. In the study's second phase, they switched to a placebo non-caffeinated beverage prepared to match the tea in color and taste. In the third phase, caffeine was added to the placebo, enough to equal that in tea.

Black tea reduced total cholesterol by 4% and LDL cholesterol by 8% compared with the effects of a placebo drink with no caffeine. When compared with a placebo with caffeine, total cholesterol was reduced by 7% and LDL cholesterol by 11% in participants consuming black tea.

The drop in cholesterol from 4% and 7% in those who consumed black tea means a decreased risk from heart disease, since a 1% decrease in cholesterol translates into about a 2% decrease in heart disease.

This could translate into an 8% to 13% decreased risk of heart disease, writes lead researcher Michael J. Davies, PhD, with the Beltsville Human Nutrition Research Center, a division of the U.S. Department of Agriculture.

"The inclusion of tea in a diet moderately low in fat reduces total and LDL cholesterol by significant amounts, and may, therefore, reduce risk of heart disease," he writes.

However, tea did not affect the patients' antioxidant levels, Davies writes. It's possible that tea limits cholesterol absorption in the intestine.

### Tea and Cancer

This is the first randomized study to look at effects of regular tea drinking -- both black and green tea -- on smoking-associated cancer prevention.

His study involved 143 men and women -- all heavy smokers -- divided into three groups. For four months, each group drank four cups a day -- one group drank decaffeinated green tea, the second group drank decaffeinated black tea, and the third drank water.

Every month, they returned to the clinic for blood tests and urinalysis. None of them cut back on smoking or changed their diet, Hakim says.

In the end: The green tea group had the lowest 8-OhdG levels; the black tea and water drinkers had no change in 8-OhdG levels. Black tea and water, therefore, seemed to have no effect in protecting smokers from DNA damage.

Green tea, however, significantly cut the cell damage in these heavy smokers, a sign that drinking tea daily could be effective in cancer prevention, writes Hakim.

Coffee drinkers, it's a message: Switching to tea can lower high cholesterol and help with cancer prevention.
Coffee: The New Health Food?
Plenty of health benefits are brewing in America’s beloved beverage, coffee.
After analyzing data on 126,000 people for as long as 18 years, Harvard researchers calculate that compared with not partaking in America’s favorite morning drink, downing one to three cups of caffeinated coffee daily can reduce diabetes risk by single digits. But having six cups or more each day slashed men’s risk by 54% and women’s by 30% over java avoiders.

Though the scientists give the customary “more research is needed” before they recommend you do overtime at Starbucks to specifically prevent diabetes, their findings, reported just two weeks ago, are very similar to those in a less-publicized Dutch study last year. And perhaps more importantly, it’s the latest of hundreds of studies suggesting that coffee may be something of a health food — especially in higher amounts.

In recent decades, some 19,000 studies have been done examining coffee’s impact on health. And for the most part, their results are as pleasing as a gulp of freshly brewed Breakfast Blend for the 108 million Americans who routinely enjoy this traditionally morning — and increasingly daylong — ritual. In practical terms, regular coffee drinkers include the majority of U.S. adults and a growing number of children.

“Overall, the research shows that coffee is far more healthful than it is harmful,” says Tomas DePaulis, PhD, research scientist at Vanderbilt University’s Institute for Coffee Studies, which conducts its own medical research and tracks coffee studies from around the world. “For most people, very little bad comes from drinking it, but a lot of good.”

Consider this: At least six studies indicate that people who drink coffee on a regular basis are up to 80% less likely to develop Parkinson’s, with three showing the more they drink, the lower the risk. Other research shows that compared to not drinking coffee, at least two cups daily can translate to a 25% reduced risk of colon cancer, an 80% drop in liver cirrhosis risk, and nearly half the risk of gallstones.

Coffee even offsets some of the damage caused by other vices, some research indicates. “People who smoke and are heavy drinkers have less heart disease and liver damage when they regularly consume large amounts of coffee compared to those who don’t,” says DePaulis.

There’s also some evidence that coffee may help manage asthma and even control attacks when medication is unavailable, stop a headache, boost mood, and even prevent cavities.

“The evidence is very strong that regular coffee consumption reduces risk of Parkinson’s disease and for that, it’s directly related to caffeine,” DePaulis tells WebMD. “In fact, Parkinson’s drugs are now being developed that contain a derivative of caffeine based on this evidence.”

Caffeine is also what helps in treating asthma and headaches. Though not widely publicized, a single dose of pain reliever such as Anacin or Excedrin contains up to 120 milligrams — what’s in a hefty mug of Joe.

It’s also caffeine — and not coffee, per se — that makes Java a powerful aid in enhancing athletic endurance and performance, says physiologist and longtime coffee researcher Terry Graham, PhD, of the University of Guelph in Canada. So powerful, in fact, that until recently, caffeine in coffee or other forms was deemed a “controlled” substance by the Olympic Games Committee, meaning that it could be consumed only in small, designated amounts by competing athletes.

“What caffeine likely does is stimulate the brain and nervous system to do things differently,” he tells WebMD. “That may include signaling you to ignore fatigue or recruit extra units of muscle for intense athletic performance. Caffeine may even have a direct effect on muscles themselves; causing them to produce a stronger contraction. But what’s amazing about it is that unlike some performance-enhancing manipulation some athletes do that are specific for strength or sprinting or endurance, studies show that caffeine positively enhances all of these things.”

In other words, consume enough caffeine — whether it’s from coffee or another source — and you will likely run faster, last longer and be stronger. What’s enough? As little as one cup can offer some benefit, but the real impact comes from at least two mugs, says Graham. By comparison, it’d take at least eight glasses of cola to get the same effect, which isn’t exactly conducive for running a marathon.

But the harder you exercise, the more benefit you may get from coffee. “Unfortunately, where you see the enhancing effects from caffeine is in hard-working athletes, who are able to work longer and somewhat harder,” says Graham, who has studied the effects of caffeine and coffee for nearly two decades. “If you a recreational athlete who is working out to reduce weight or just feel better, you’re not pushing yourself hard enough to get an athletic benefit from coffee or other caffeinated products.”
On Nutritious Drink Studies, Consider the Funding Source

By Kathleen Doheny, HealthDay Reporter

TUESDAY, Jan. 9 (HealthDay News) -- Before you take to heart any research about the health effects of beverages such as milk, fruit juice or soft drinks, find out who paid for the study.

If a beverage manufacturer or industry group funded the research, the finding may be biased, researchers report.

"When a food company sponsors a study, it is much more likely to be positive" about the health effects of the product, said Dr. David Ludwig. He's the study's senior author and director of the Optimal Weight for Life program at Children's Hospital Boston, the pediatric teaching hospital for Harvard Medical School.

Ludwig and his colleagues analyzed 206 articles from medical journals that evaluated the health benefits or effects of soft drinks, juice and milk. The studies were published from 1999 to 2003.

Of the 206 studies, 111 supplied information on funding. To prevent bias in Ludwig's review, one researcher selected the articles for inclusion in the study. Another two researchers who were not told the funding sources classified each study as favorable, not favorable or neutral toward the beverage studies. A fourth researcher who didn't know the conclusions of the study determined the funding source and classified the studies, based on whether they would be beneficial, negative or neutral to the funder's bottom line.

In all, 22 percent of the studies were funded totally by industry, while 32 percent had both industry and independent funding.

"We found when a food company pays for a study, the results are about eight times more likely to be favorable to the company's financial interest than when the studies are funded independently," Ludwig said. "It is a strong association. It raises concern for bias."

The same association has been found in studies of medications funded by drug companies, Ludwig said. But, he added, bias in studies of beverages could have a greater impact because nearly everyone drinks milk, juices or soft drinks.

"This is the first time this issue has been investigated systematically in the area of nutrition," Ludwig said. "More research needs to be done. No one study can prove an issue. This [conclusion] argues for the need for more independent funding" of research.

The results of Ludwig's study are published in the Jan. 9 online issue of the journal PLoS Medicine.

Susan K. Neely, president and chief executive officer of the American Beverage Association, took exception to the study.

"This is yet another attack on industry by activists who demonstrate their own biases in their review by looking only at the funding source and not judging the research on its merits. The science is what matters -- nothing else," she said in a prepared statement.

In an accompanying perspective article in the journal, Martijn Katan, professor of nutrition at Vrije Universiteit Amsterdam in the Netherlands, noted that a "blanket condemnation of industry-supported research" isn't the answer. He said collaboration with industry allowed him "to discover things that I could not have found otherwise." For instance: "We discovered the effects of trans fatty acids on heart-disease risk thanks to the expertise of Unilever, and the cholesterol-raising factor in unfiltered coffee thanks to Nestle."

"In the Netherlands, Katan wrote, "The Royal Netherlands Academy of Sciences has put forth an innovative proposal on how to supervise relations between researchers and their sponsors."

Until more guidance is available, another expert, Connie Crothers, director of university nutrition at Washington University in St. Louis, has a suggestion, "The [Ludwig] study reminds consumers and the media that all research studies should be viewed as one part of the puzzle about food and health and not conclusive answers to questions."

Any conclusions must come from several studies, not one, she added.

But while this may seem like good news, any celebration is premature, according to a statement released Tuesday by Karen Davis, president of The Commonwealth Fund, a private foundation that supports independent research on health and social issues. The U.S. still spends more than twice what other industrialized countries spend on health care per person, and even the slower spending growth continues to outpace inflation and growth in wages for the average U.S. worker.

More information
To learn more about "functional" beverages, visit the American Dietetic Association.

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URL:
Observational Studies Can Produce Skewed Results
By Amanda Gardner, HealthDay Reporter

TUESDAY, Jan. 16 (HealthDay News) -- The results of so-called observational studies can vary greatly, depending on the type of statistical analysis the researchers use.

So caution needs to be exercised when interpreting the results of these types of studies, claim the authors of new research published in the Jan. 17 issue of the Journal of the American Medical Association.

Randomized, controlled studies are considered the gold standard of medical science. In such trials, patients are randomly assigned to receive either the treatment or a placebo. The participants are then monitored for a certain period of time to determine the results.

But such studies are expensive, difficult to conduct and often involve ethical challenges.

Observational studies are a less expensive, less cumbersome alternative; patients are simply enrolled in the trial and observed in a natural setting, not a research setting, such as a hospital.

"We need to be more skeptical" of observational studies, said Therese A. Stukel, lead author of the new research. "You can't just throw a standard model at it and assume you're going to get a correct result. None of this stuff is written in stone."

"The patients haven't been randomized" in an observational study, added Stukel, a professor of community and family medicine at Dartmouth Medical School, and a senior scientist at the Institute for Clinical Evaluative Sciences in Toronto.

"They have been selected by physicians and differences in outcome could be due to treatment or due to the patients you selected."

For example, physicians often select healthier patients for surgery. That could skew the results, she said.

Generally, factors that can be measured -- such as income or age -- are accounted for in observational studies. But standard statistical models can't account for unmeasurable factors such as a physician's own selection bias, Stukel said.

For the new study, the authors used four different analytic methods on the same set of research data to see if and how the results varied. The methods were: "multivariable model risk adjustment"; "propensity score risk adjustment"; "propensity-based matching"; and "instrumental variable analysis."

The first three methods are standard statistical tools. Instrumental variable analysis attempts to adjust for unmeasurable factors. "The key is that it behaves like randomization," Stukel explained.

The study included 122,124 elderly patients on Medicare who had been hospitalized with a heart attack in 1994 or 1995 and were eligible for cardiac catheterization -- a procedure in which a tube or catheter is inserted into a vessel in the arm or leg and then on into the heart or coronary arteries.

The patients who underwent cardiac catheterization were younger and had had a less severe heart attack than those who did not. All participants were followed for seven years.

The three standard statistical models showed a 50 percent decrease in mortality within 30 days of the procedure among those undergoing cardiac catheterization.

"This mortality is too favorable," Stukel said. "No cardiologist believes it. In fact, randomized trials very recently show an 8-to-21-percent mortality decrease. We knew that 50 percent was completely off the scale."

But the instrumental variable analysis showed only a 16 percent relative decrease in mortality, which was well within the range of the randomized studies.

"The bottom line is there are plenty of situations where standard methods work, and typically they work when we're selecting patients to two treatment groups where the groups are the same and the risks are the same," Stukel said. "The classic situation where they don't work is where you're looking at surgical vs. non-surgical treatments where you need to be healthier to survive surgery and you need to survive long enough to get the surgery so, if you die early, it may look like you weren't chosen for the trial."

"It would be nice to have a bottom line that every study should be a randomized, controlled study. But there are financial and ethical impediments so we still need observational studies," she continued. "But we need to be cautious and we need to think hard about whether that comparison is a fair comparison."

More information
To find out more on how clinical trials are conducted, visit the U.S. National Institutes of Health.

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Nov. 10, 2003 (Orlando, Fla.) -- Pound for pound, four very popular weight loss diets are all good for shedding weight and lowering the risk of heart disease, say researchers, with one important caveat: You have to stick with the diets, not just start them.

The diet scene has heated up in the past year with low-carb and low-fat diets battling it out. But until now no one actually compared four of the most popular diets -- Atkins, Ornish, Weight Watchers and the Zone -- to find out which was really better for weight loss and lowering the risk of a heart disease.

It turns out, says Michael L. Dansinger, MD, assistant professor of medicine at Tufts University, New England Medical Center in Boston, Mass. that as long as the pounds are shed, heart health improves.

"Losing 20 pounds corresponded to about a 30% reduction in heart risk score," he says. Although he explains that at this point "it isn't clear if a 30% reduction in risk score is the same as a 30% reduction in heart attacks." Dansinger presented his results here at the American Heart Association's Scientific Sessions 2003.

The Contenders

- The Atkins diet -- a low-carb diet consisting primarily of protein and fat. In the first two weeks, carbohydrates are severely restricted but then are introduced back into the diet in the form of fiber-rich carbohydrates.
- The Ornish diet -- a high-carb, low-fat vegetarian diet of mostly beans, fruits, grains, and vegetables. Dairy products are eaten in moderation and meats are discouraged.
- Weight Watchers -- a low-fat, high-carb diet where each food is assigned a point value and participants are allowed a certain number of points per day.
- The Zone -- a diet based on a 40-30-30 system where participants eat 40% of their calories from "favorable" carbohydrates such as vegetables and beans, 30% from low-fat proteins, and 30% from unsaturated fats, such as olive and canola oils, nuts, and avocados.

Low-Carb vs. Low-Fat

Dansinger studied 160 overweight men and women who volunteered to participate in a yearlong diet study. Forty volunteers were assigned to each diet, he says. Dansinger says he was just testing the diets, not any exercise or other lifestyle modifications that are part of the entire diet program." The researchers also calculated a score to estimate a person's heart disease risk -- based on common heart disease risk factors, such as cholesterol and blood pressure.

The benefits from the diets were limited to those who carefully followed them -- and following the diets was no easy task since the drop out rate for each diet was 22% at two months. By one year half of the volunteers assigned to Atkins or Ornish had dropped out as had 35% of those assigned to Weight Watchers or Zone diets.

Participants following the Atkins, Weight Watchers, and Zone diets achieved significant reductions in the heart risk score. Those following the Ornish diet did not show any significant improvement in the heart disease risk score.

Dansinger tells WebMD that this does not mean that the "Ornish diet doesn't reduce heart disease risk. I have great faith in the Ornish diet, but it did not meet the statistical test in this study."
Ornish Responds

Dean Ornish, MD, founder and president of the Preventive Medicine Research Institute in Sausalito, Calif, was immediately critical of the results.

Ornish tells WebMD that the people assigned to his diet "lost more weight, had greater reductions in LDL, (the 'bad' cholesterol), and were the only dieters to significantly lower insulin — even though the Atkins and Zone diets claim to be specifically designed to lower insulin." Lower insulin levels indicate a lower risk of developing diabetes, another powerful heart disease risk factor.

Dansinger, who joined Ornish in fielding questions from reporters, agrees that the Ornish diet posted impressive results for those who stayed the course for a year: a nearly 20% reduction in insulin levels while the Atkins diet dropped insulin by about 8% and the Zone was associated with a 17% drop in insulin.

Likewise, the Ornish diet reduced LDL cholesterol by 17%, while the Atkins dieters reduced LDL by 9%, followed by Weight Watchers dieters at 8% and Zone dieters at 7%.

Good Cholesterol: How Important Is It?

But the heart disease risk score is based on the ratio between LDL cholesterol and HDL "good" cholesterol.

"The Ornish diet does not increase HDL, while the other diets do achieve significant increases in HDL," says Dansinger. The Atkins and Zone diets increased HDL by 15%, while Weight Watchers posted an 18.5% gain. But the Ornish diet increased HDL by just 2.2%.

Ornish says HDL is not really a factor because "HDL is really like a garbage truck that goes around picking up the garbage, which is bad cholesterol. When you don't have as much bad cholesterol -- garbage -- you don't need as many garbage trucks." He adds, "raising HDL is easy: eat a stick of butter. That will drive up your HDL, but it's not good for you."

Dansinger says HDL is a little more complicated. For example, "exercise increases HDL and we do think that low HDL is a risk factor for heart disease," he says.

"The good news about this study is that we have demonstrated that all these diets work. That means that physicians can work with patients to select the diet that is best suited to the patient. For example, if you have a patient who likes meat, it is unlikely that he or she will comply with the Ornish diet," says Dansinger.

"In the short run, I think weight loss trumps everything. If you lose weight, it doesn't matter how you lose it. But in the long run we don't know the effect of the macronutrients [carbohydrates, fats, and proteins] that you are eating," says Robert H. Eckel, MD, chair of the American Heart Association's Nutrition, Physical Activity, and Metabolism Council and professor of medicine at the University of Colorado Health Sciences Center. Eckel was not involved in the study.

Source: American Heart Association Scientific Sessions 2003, "One Year Effectiveness of Atkins, Ornish, Weight Watchers and Zone Diets in Decreasing Body Weight and Heart Disease Risk," Michael Dansinger, MD, Tufts; Dean Ornish, MD, Preventive Medicine Research Institute; Robert H. Eckel, MD, chair, AHA Nutrition, Physical Activity, and Metabolism Council.

WebMD Medical Reference: Evaluate the Latest Diets.

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Walnuts May Beat Olive Oil for Heart Health

By Ed Edelson, HealthDay Reporter

MONDAY, Oct. 9 (HealthDay News) -- A high-fat dinner followed by an unusual dessert suggests that walnuts might be even better for the arteries than olive oil, Spanish researchers report.

The dinner consisted of a salami and cheese sandwich on white bread, plus high-fat yogurt. The "dessert" consisted of five teaspoons of olive oil for half the diners and 40 grams of walnuts (about eight shelled nuts) for the other half.

Ultrasound examinations showed that the arteries of those eating the walnuts stayed more flexible and elastic after the fatty meal than those of the folks who ate olive oil. The study's 24 adult participants had varying levels of blood cholesterol, ranging from healthy to moderately high.

"This study shows the mechanism for the beneficial effects of walnuts," contended study lead researcher Dr. Emilio Ros, director of the Lipid Clinic at Hospital Clinico in Barcelona.

While olive oil and walnuts decrease the onset of inflammation and oxidation in the arteries after a high-fat meal, but walnuts preserve the blood vessels' flexibility while olive oil does not, according to Ros. He attributed much of the beneficial effect to the alpha-linolenic acid found in walnuts. This nutrient is similar to the omega-3 fatty acids found in fish.

The study, which was funded in part by the California Walnut Board, was expected to be published in the Oct. 17 issue of the Journal of the American College of Cardiology.

Ros points out that authorities such as the American Heart Association recommend that Americans eat at least two fish servings a week, preferable oily fish rich in omega-3 fatty acids. Omega-3s increase blood levels of HDL cholesterol, the "good" kind that helps keep arteries clear.

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The California Walnut Board -- which has also funded several similar studies -- petitioned the U.S. Food and Drug Administration more than two years ago for its permission to formally claim that walnuts reduce the risk of heart disease.

So far, the FDA has only approved a "qualified health claim," which says that "supportive but not conclusive research shows that eating 1.5 ounces of walnuts per day as part of a low-saturated-fat and low cholesterol diet, and not resulting in increased caloric intake, may reduce the risk of coronary heart disease."

For its part, the American College of Cardiology had the paper reviewed by Dr. Robert A. Vogel, professor of medicine at the University of Maryland. He issued a statement saying, "This demonstrates that the protective fat from walnuts actually undoes some of the detrimental effects of a high-saturated-fat diet, whereas a neutral fat, such as olive oil, does not have as much protective ability."

People who eat the so-called "Mediterranean diet" -- lauded by many nutritionists as heart-healthy -- believe that olive oil provides the major cardiac benefit, "but this research indicates that's not true," Vogel said. "There are probably other factors in the diet, including that it is a relatively rich source of nuts."

More research is needed to determine whether the protective effect of walnuts is affected by heating and cooking, or whether they are best eaten raw, he added.

More information

More on the nutritional benefits of walnuts is found on the FDA's Web site.

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• Q: Is It Possible to Lower Your Cholesterol 120 Points In Three Months?
• Good Cholesterol, Bad Cholesterol and Exercise
• The Cholesterol Connection
• Does Coffee Raise Cholesterol?

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Compost in Red Wine Boosts Health of Obese Mice

By Steven Reinberg, HealthDay Reporter

HealthDay

WEDNESDAY, Nov. 1 (HealthDay News) -- In another study that suggests red wine may be good for your health, researchers found that old, obese mice that were fed a high-fat diet plus the compound resveratrol were healthier and lived longer than their counterparts that didn't get resveratrol.

Resveratrol is a naturally occurring compound found in red wine, grapes and nuts. Other studies have found that resveratrol can extend life in yeast, worms, fruit flies and fish. It appears to be associated with anti-aging and preventing the effects of diseases of aging, such as diabetes, cancer and dementia.

"Resveratrol extends the lifespan of every species we have fed it to," said lead researcher David Sinclair, an associate professor of pathology at Harvard Medical School. "We are now showing that this is also possible for mice on a high-fat diet," he added.

The study findings are published in the Nov. 2 issue of Nature.

The researchers found that, among the overweight mice, resveratrol reduced the negative impact of being obese. When the mice were 60 weeks old, those mice receiving resveratrol showed a three- to four-month increase in survival, compared to mice not receiving the compound.

By 114 weeks, when the mice reached old age, more than half of the animals on a high-fat diet alone had died, compared to less than one-third of those receiving resveratrol.

"The goal is to turn this knowledge into drugs that would treat diseases of aging, like diabetes, heart disease and Alzheimer's," Sinclair said. "It's hard to know how far we can go with this technology. We are in new territory. We have never had a molecule that can achieve these effects in such diverse animals."

Resveratrol works by activating an enzyme called SIRT-1, which is found in all life forms and appears to control aging, Sinclair said. "It's triggering ancient pathways that counter diseases and aging," he said.

In addition, resveratrol stabilizes blood sugar and other effects of obesity. Sinclair speculated that a drug could be developed that would protect against diabetes, cancer, Alzheimer's and heart disease.

But, Sinclair noted, the results of these studies are preliminary. "I don't recommend that people go out and just take products that claim to have resveratrol in them," he said.

Co-researcher Rafael de Cabo, an investigator at the U.S. National Institute on Aging, cautioned, "This is only a mouse study. We have to repeat it.

"The data is amazing," he added. "But every time you open a door in research, we find a thousand new doors, so there are a lot of questions still to be answered."

There are currently two human trials testing the value of resveratrol. One, at the University of California, includes patients with colon cancer. The other one, sponsored by Sirtris Pharmaceuticals, includes diabetes patients. Sinclair is one of the founders of Sirtris.

"We have taken an improved form of resveratrol into a human diabetes trial," said Sirtris CEO Dr. Christoph Westphal. The trial is testing whether the new drug is safe and whether it will control blood sugar. The researchers expect to have results in late 2007, Westphal said, adding, it will be at least four to five years before resveratrol drugs might be available.

One expert thinks that while the results of this study are impressive, there's a long way to go before resveratrol is proven safe and effective.

"As provocative as these findings are, it is not yet time to start popping resveratrol supplements, or rely on the compound as an alternative to healthful eating, physical activity, or attempts at weight control," said Dr. David L. Katz, an associate professor of public health and director of the Prevention Research Center at Yale University School of Medicine.

Time and again, promising findings in test tubes and mice have failed to translate into human benefit, Katz said. "The list of such disappointments includes almost every nutrient that has at one time or another captivated the public's imagination, including, over recent years, beta carotene, vitamin C, and vitamin E."

This research should make on-going study of resveratrol a priority, Katz said. "While hoping that the promise of benefit without harm is fulfilled in people, I would advise against leaping to that conclusion until the evidence comes in," he said.

More information

Oregon State University can tell you more about resveratrol.

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Orange tomatoes better for you?
Special variety contains more easily absorbed antioxidant, scientists say

Reuters

Food scientists at Ohio State University in Columbus have grown a special variety of orange tomatoes that may be healthier than garden-variety red tomatoes. The orange tomatoes contain a type of lycopene that is more readily used by the body than the type found in red tomatoes, they report.

Lycopene — an antioxidant thought to have a number of health benefits such as reducing the risk of cancer, heart disease and age-related eye problems — is what gives red tomatoes and other fruits and vegetables their rich color.

Dr. Steven Schwartz and colleagues had 12 adult volunteers eat two spaghetti test meals on separate occasions. One meal was made with sauce from the orange tomatoes and the other with sauce from red tomatoes. For 13 days before the test meals, the volunteers avoided eating tomatoes or food made with them.

Blood samples taken from each subject right before the spaghetti meals and every hour or two up to 10 hours after the meals were analyzed for lycopene content.

Results showed that lycopene absorption from the orange tomato sauce was 2.5 times higher than that absorbed from the red tomato sauce. Blood lycopene levels spiked about 5 hours after the orange tomato sauce meal and at this time the levels were some 200 times higher than those seen after the red tomato sauce meal.

"While red tomatoes contain far more lycopene than orange tomatoes, most of it is in a form that the body doesn't absorb well," Schwartz, a professor of food science and technology at Ohio State, explained in a university-issued statement.

"The people in the study actually consumed less lycopene when they ate sauce made from the orange tomatoes, but they absorbed far more lycopene than they would have if it had come from red tomatoes," he noted.

The orange tomatoes are not readily available at grocery stores; they were grown at an Ohio State-affiliated agricultural research center. Schwartz and colleagues suggest that interested consumers could seek out orange or gold-colored heirloom tomatoes as an alternative — although they haven't tested how much or what kind of lycopene these varieties contain.
Dark chocolate good for blood vessels
8 ounces of cocoa daily improved function in small study

NEW ORLEANS - Chocoholics were given further reason to rejoice on Saturday when a small clinical study showed that dark chocolate improves the function of blood vessels.

While the researchers cautioned against bingeing on bon bons, they said the findings of the trial were clear and called for larger such studies to confirm the results.

"In this sample of healthy adults, dark chocolate ingestion over a short period of time was shown to significantly improve (blood vessel) function," said Dr. Valentine Njike of Yale Prevention Research Center, a co-investigator of the study.

The results, presented at the annual American College of Cardiology scientific meeting in New Orleans, add to mounting evidence of the health benefits of dark chocolate.

During the six-week trial, 45 people were given 8 ounces (227 grams) of cocoa without sugar, cocoa with sugar or a placebo each day.

An upper arm artery's ability to relax and expand to accommodate increased blood flow — known as flow mediated dilation (FMD) — was measured using high-frequency ultrasound before and after daily cocoa or placebo consumption.

Of the 39 subjects who completed the trial, FMD improved significantly in both cocoa groups —by 2.4 percent among those who had it without sugar and 1.5 percent among those who had it with sugar. It dropped 0.8 percent in the placebo group.

"While the findings from this study do not suggest that people should start eating more chocolate as part of their daily routine, it does suggest that we pay more attention to how dark chocolate and other flavonoid-rich foods might offer cardiovascular benefits," Njike said.

Study: Cocoa calms blood pressure
Chemicals in chocolate, but not tea, as effective as hypertension drugs

CHICAGO - Some may see a cup of tea as soothing, but chocolate is more likely to lower one's blood pressure, German researchers reported Monday.

Foods rich in cocoa appear to reduce blood pressure, but drinking green and black tea may not, according to an analysis of previously published research in the Archives of Internal Medicine, published by the American Medical Association.

The drop in blood pressure among participants who consumed cocoa products for at least two weeks was in the same range as achieved by someone taking drugs commonly prescribed to control high blood pressure.

The fall in blood pressure credited to cocoa could be expected to reduce the risk of strokes and heart attacks by 10 percent to 20 percent, the report said.

Both cocoa and tea contain polyphenols, a class of chemicals known to help prevent cardiovascular disease, and are present in most fruits and vegetables. But cocoa has a different type than tea — procyanids — that appear to be more active.

Currently, patients with high blood pressure are urged to eat more fruits and vegetables, although cocoa and tea products account for the bulk of total polyphenol consumption in Western countries, the study said.

But don't start gobbling up chocolate bars just yet, wrote study author Dirk Taubert of the University Hospital of Cologne, Germany.

Treats such as dark chocolate might be substituted for other high-calorie desserts, based on the study's findings, but "we believe that any dietary advice must account for the high sugar, fat and calorie intake with most cocoa products.

"Rationally applied, cocoa products might be considered part of dietary approaches to lower hypertension risk," he wrote.
Exposure to Drunk Driving

A chi-square analysis revealed that those who reported riding with a reckless driver were also more likely to report riding with a drunk driver, [chi square] (1) = 117.26, p < .001, as well as a drag racing driver, [chi square] (1) = 124.55, p < .001. Those who reported riding with a reckless driver were less likely to report using their seatbelt, [chi square] (1) = 22.2, p < .001. There was also a significant difference in the level of speed that was considered speeding between the two groups, with those who reported exposure to reckless driving flying a higher speed limit (see Table 2).

Gender

Males were more likely to report higher levels of confidence in their future ability to drive than did females, [chi square] (2) = 68.03, p < .001, as well as a greater exposure to drag racing, [chi square] (1) = 11.54, p < .001. Females were more likely to have ridden with a drunk driver, [chi square] (1) = 5.58, p < .05. Significant gender differences were also found in terms of considering a risky behavior as dangerous. Out of the six self-reported dangerous behaviors they were asked to rate, four of them showed significant gender differences (speeding, drunk driving, distracted driving, slow driving), with females rating the behavior as more dangerous in each case (see Table 3).

Cell Phone Use

In terms of cell phone use, only 14% believed it was never acceptable to use a cell phone while driving.

There was also a significant difference between genders in terms of what driving speed was considered speeding (M = 85.77 mph, SD = 17.93) than that reported by males (M = 91.52 mph, SD = 31.39).

RESULTS: TRAFFIC VIOLATIONS

Participants in the second study were taking the traffic safety course because of a range of traffic violations, but the most common was speeding (55%). These violators reported an average of 22.5 mph (SD = 11.71) over the posted speed limit when they were pulled over. The next highest number of violations were reported as failing to stop at a stop sign (11%), failure to stop at a red light (8%), reckless driving (4.3%), and drag racing (4.2%). Of the remaining participants, 24% selected “other”; these write-in traffic violations included crossing a double yellow line on a freeway, driving without a license, unsafe lane changes, and hit and run. The average length of time these drivers had had their licenses was 12.7 months.

For dangerous driving behaviors, drunk driving was rated the most dangerous, with sleepy driving, distracted driving, angry driving, and slow driving following in order (see Table 1).

In terms of personal exposure, 38.5% said they had been in a car with a drunk driver; 44.2% had ridden with someone who was drag racing; 53.6% had ridden with a reckless driver; and 35.2% had been in a vehicle where the driver had used drugs prior to getting behind the wheel.

For their own reported behavior, 17% of the participants reported drinking while drunk, 20.9% of them reported drag racing, 27.2% said they had driven recklessly, and 17.8% said they had taken illegal drugs while driving.

Those participants who reported more mildly aggressive behaviors by their parents (yelling, rude gestures, honking/flashing lights) also viewed such behaviors as more acceptable, r = .340, p < .001.

Exposure to Drunk Driving

Those who had been in a vehicle with a drunk driver were significantly more likely to have been exposed to drag racing, [chi square](1) = 16.22, p < .001, reckless driving, [chi square](1) = 95.84, p < .001, and riding with a driver under the influence of drugs, [chi square](1) = 164.19, p < .001, than did those who had not been directly exposed to drunk driving. In terms of their own behavior, they were more likely to have engaged in reckless driving, [chi square](1) = 5.62, p < .05, and to have reported using drugs while driving, [chi square](1) = 7.27, p < .05. Participants who reported exposure to drunk driving also had a significantly higher level of exposure to what they considered speeding than did those who did not report such exposure; they were also less likely to rate drunk driving as a risky behavior than did those who had not been exposed to it (see Table 4).

Exposure to Drag Racing

Participants who reported exposure to drag racing also reported exposure to reckless driving, [chi square](1) = 101.75, p < .001, drunk driving, [chi square](1) = 95.22, p < .001, and ridden with a driver who was under the influence of illegal drugs, [chi square](1) = 104.84, p < .001. They were also more likely to have engaged in drag racing as a driver, [chi square](1) = 7.91, p < .0.01. Drivers who did not report exposure to reckless driving were more likely to have engaged in reckless driving and sleepy driving as more risky than did those who had been exposed to reckless driving (see Table 4).

Cell Phone Use

Concerning the safety of cell phone use on the road, 27.6% believed it was acceptable while driving after 100 hours of driving experience, while 25.3% believed it was acceptable after 100 hours. Only 13% believed it was never acceptable to use a cell phone while driving.

Gender

As in the findings for student drivers, males reported a higher confidence level in their driving than did females, [chi square](2) = 40.46, p < .001. In terms of traffic offenses, males were more likely to have been pulled over for drag racing, [chi square](1) = 15.51, p < .001, and reckless driving, [chi square](1) = 7.07, p < .01, than were females. Females in this sample were more likely to be pulled over for speeding, [chi square](1) = 7.42, p < .01.

There were reported gender differences in terms of all four self-reported driving behaviors. Males were more likely to have driven while drunk, [chi square](1) = 24.12, p < .001, and used drugs while driving, [chi square](1) = 5.5, p < .05, than were females. Females rated three of the six risky driving behaviors as being significantly more dangerous than did males: drunk driving, sleepy driving, and angry driving (see Table 3).

Differences Between Non-Drivers and Traffic Violators

In the rating of dangerous behaviors, significant differences were found between the non-drivers and the teens attending traffic school on four of the six ranked behaviors. Student drivers rated speeding, drunk driving, angry driving, and sleepy driving as significantly more risky than did the teens who had received traffic citations (see Table 1).

Traffic Violators were significantly more likely to have been exposed to risky driving behavior than were the student drivers. This was true for exposure to drunk driving (t = 4.922, p < .000), drag racing (t = 158.599, p < .001), and reckless driving (t = 6.90, p < .000).
Mendelian Genetics

The Chi-Square Test

An important question to answer in any genetic experiment is how can we decide if our data fits any of the Mendelian ratios we have discussed. A statistical test that can test out ratios is the Chi-Square or Goodness of Fit test.

Chi-Square Formula

\[ \chi^2 = \sum \frac{(\text{Observed Value} - \text{Expected Value})^2}{\text{Expected Value}} \]

Degrees of freedom (df) = n - 1 where n is the number of classes

Let's test the following data to determine if it fits a 9:3:3:1 ratio.

<table>
<thead>
<tr>
<th>Observed Values</th>
<th>Expected Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>315 Round, Yellow Seed</td>
<td>(9/16)(556) = 312.75 Round, Yellow Seed</td>
</tr>
<tr>
<td>108 Round, Green Seed</td>
<td>(3/16)(556) = 104.25 Round, Green Seed</td>
</tr>
<tr>
<td>101 Wrinkled, Yellow Seed</td>
<td>(3/16)(556) = 104.25 Wrinkled, Yellow Seed</td>
</tr>
<tr>
<td>32 Wrinkled, Green Seed</td>
<td>(1/16)(556) = 34.75 Wrinkled, Green Seed</td>
</tr>
<tr>
<td>556 Total Seeds</td>
<td>556.00 Total Seeds</td>
</tr>
</tbody>
</table>

\[ \chi^2 = \frac{(315 - 312.75)^2}{312.75} + \frac{(108 - 104.25)^2}{104.25} + \frac{(101 - 104.25)^2}{104.25} + \frac{(32 - 34.75)^2}{34.75} \]

\[ \chi^2 = \frac{16.76}{312.75} + \frac{1.81}{104.25} + \frac{1.81}{104.25} + \frac{3.76}{34.75} \]

\[ \chi^2 = 0.05 + 0.02 + 0.02 + 0.11 = 0.10 \]

Number of classes (n) = 4
df = n - 1 + 4 - 1 = 3

Chi-square value = 0.47

Enter the Chi-Square table at df = 3 and we see the probability of our chi-square value is greater than 0.90. By statistical convention, we use the 0.05 probability level as our critical value. If the calculated chi-square value is less than the 0.05 value, we accept the hypothesis. If the value is greater than the value, we reject the hypothesis. Therefore, because the calculated chi-square value is greater than the we accept the hypothesis that the data fits a 9:3:3:1 ratio.