



*The Beverage Institute
For Health & Wellness*

Beverage Science Update

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Consuming Soft Drinks Does Not Raise Risk for Esophageal Cancer

Yale and Karolinska Institute Studies Refute Suggested Soda-Cancer Link; Find Soft Drink Users No More Likely to Develop Esophageal Cancer than Non-Users.

Two large independent epidemiological studies, one conducted at Yale University Medical School in the U.S. and the other at the Karolinska Institute in Sweden, have found that soft drink consumers are at no greater risk for developing esophageal cancer than those who never consume soft drinks. The studies findings were published in separate articles that appeared in the Journal of the National Cancer Institute during the first half of 2006.

Both studies were large-scale population (epidemiological) studies that collected data on the long-term soft drink use of people with esophageal cancer and a group of cancer-free controls in order to specifically determine whether soft-drink users were at greater risk of developing esophageal cancer. The studies were conducted to test a theory raised by ecological data presented at research conference in 2004. The researcher who presented that data suggested that because esophageal reflux is a known risk factor for esophageal cancer and reflux has been associated with soft-drink use, that a viable 'biological explanation' for the dramatic rise in esophageal cancers among white males in the U.S. over the past 25 years could be the similar rise in that population's soft drink consumption over that same period. The researcher developed his case by comparing published health statistics on esophageal cancers with U.S. Dietary Intake data on soft drink consumption. The study did not present data on the actual long-term soft-drink consumption of men who developed esophageal cancer or of men who did not develop this type of cancer.

Although conducted independently, both the Yale and Swedish research studies did compare the long-term soft drink consumption of groups of people who were similar except that some had developed esophageal cancer and the others had not. And, they came to the same conclusion: contrary to the suggested link between soft drink use and esophageal cancer, soft drink users, especially those who drank diet soft drinks, actually had a slightly lower risk of developing esophageal cancer than those who avoided soft drinks.

The research abstracts for each of these studies appear at the end of this article.

About the Yale University School of Medicine Study

This multi-center, population-based case-control epidemiological study involved more than 1700 people – two-thirds of whom had gastric and esophageal cancers -- living in Connecticut, New Jersey and western Washington State. The goal was to determine whether carbonated soft drink use is a risk factor for esophageal and gastric cancers. For the study, the participants were asked to recall the amount and frequency of regular and diet soft drink consumption during the three to five year period prior to diagnosis (for those with cancer) or, for those without cancer, the three to five years prior to the interview date. The study results were published in January 2006 in the Journal of the National Cancer Institute.

The study found that, contrary to the suggested positive association by the ecological study, carbonated soft drink consumption, and particularly diet soft drink consumption, was actually *inversely* associated with the risk for cancer of the esophagus. In other words, those who reported a history of drinking the most soft drinks, especially diet soft drinks, during the three to five year period of interest to the study were actually less likely to have gastric or esophageal cancers. The authors concluded that while esophageal cancer is largely preventable, there is no evidence that avoiding carbonated soft drinks would help lower the incidence of esophageal cancer.

About the Karolinska Institute Study

Swedish scientists working at the Unit of Esophageal and Gastric Research of the Karolinska Institute in Stockholm analyzed data from a Swedish nationwide, population-based case-controlled study to determine whether a history of carbonated soft drink use could explain the incidence of esophageal cancer in individual Swedish citizens. The study involved more than 1270 people under the age of 80, one-third of whom had gastric and esophageal cancers. The participants were interviewed about their previous consumption of regular and diet soft drinks and low-alcohol beer. In addition, known risk factors for esophageal cancer, including reflux symptoms, body mass (BMI), tobacco use, other alcohol use, socioeconomic status and intake of fruits and vegetables were also assessed. The study findings were published in August 2006 in the Journal of the National Cancer Institute.

The study found no association between carbonated soft drink use and the risk for cancer of the esophagus. Specifically:

- Soft-drink users had no higher risk of esophageal cancer, when compared to those who never consumed soft drinks, irrespective of their frequency of consumption.
- High-consumers of soft drinks—those who drank soft drinks more than six times per week -- actually had a slightly lower risk when compared to those who never consumed soft drinks
- The study also found that low-alcohol beer consumers also had no higher risk of esophageal cancer than those who never drank that beverage.

The authors also noted that the estimates of cancer risk did not change after adjustment for esophageal reflux and obesity (two known risk factors for esophageal cancer), which provided further evidence against the theory that use of soft drinks contribute to the rising incidence of esophageal cancer in western societies.

Assessment

- The study that first raised the question of whether soft-drink use increased esophageal and stomach cancer risk was an ecological study. The researcher compared reported incidence of esophageal cancer in the US and soft drink consumption data reported by the USDA for various populations (for example, all white males over 18 years of age). As a result, this study only identified a question (i.e. could the rise in soft drink consumption identified in the US population via the USDA data be linked to the rise in esophageal cancers identified by healthcare researchers?), which needed, in turn, to be tested via case-controlled epidemiological studies to determine whether the association was real or temporal coincidence. In ecological studies the unit of observation is the population or community. Data on disease rates and data on exposures are compared in various populations to determine if the data trends suggest a relationship may exist. Often the information about disease and exposure is abstracted from published statistics and therefore does not require data collection.
- The studies, reported in the Journal of the National Cancer Institute by researchers at Yale and the Karolinska Institute, were both case-controlled observational epidemiologic studies. These studies collected data on long-term soft drink use by individuals with and without esophageal cancer. Because these studies did a side-by-side comparison of soft-drink use by individuals with cancer and similar people who were cancer-free and found no difference, the researchers were confident in ruling out soft drink use as a risk factor in esophageal cancers.
- Although still relatively rare, adenocarcinoma of the esophagus, the type of cancer investigated in these studies, has increased significantly in the past 20 years. However, researchers believe that it is largely a preventable disease. Known risk factors, which researchers suggest are responsible for up to 80 percent of these cancers, include tobacco use, obesity, gastrointestinal reflux disease, and low intake of fruit and vegetables.

The Beverage Institute For Health & Wellness is a scientific organization within The Coca-Cola Company that supports scientific research, education and outreach with a primary focus on beverages. For more information, see www.thebeverageinstitute.org.

ABSTRACTS:

Yale University School of Medicine abstract:

Lagergren J, Viklund P, Jansson C. **Carbonated soft drinks and risk of esophageal adenocarcinoma: a population-based case-control study.**

J Natl Cancer Inst. 2006;98(16):1158-61.

The increased intake of carbonated soft drinks parallels the incidence of esophageal adenocarcinoma. To determine whether an association exists between carbonated drink intake and esophageal and cardia adenocarcinoma, we analyzed data from a Swedish nationwide, population-based, case-control study. During data collection in 1995-1997, 189 patients with esophageal adenocarcinoma (88% of all eligible), 262 patients with cardia adenocarcinoma (84%), and 820 control subjects (73%) were interviewed in person. All cancers were histologically classified. We calculated odds ratios with 95% confidence intervals using conditional logistic regression and multivariable analyses. Frequency of intake of carbonated soft drinks was not associated with risk of esophageal adenocarcinoma; high consumers (intake more than six times weekly) were at a statistically nonsignificantly decreased risk compared with never users (odds ratio = 0.89, 95% confidence interval = 0.49 to 1.64). Consumption of carbonated low-alcohol beer and combined intake of carbonated drinks were not associated with risk of esophageal adenocarcinoma. No association between intake of carbonated soft drinks or low-alcohol beer and risk of cardia adenocarcinoma was observed.

The Karolinska Institute abstract:

Mayne ST, Risch HA, Dubrow R, Chow WH, Gammon MD, Vaughan TL, Borchardt L, Schoenberg JB, Stanford JL, West AB, Rotterdam H, Blot WJ, Fraumeni JF Jr. **Carbonated soft drink consumption and risk of esophageal adenocarcinoma.**

J Natl Cancer Inst. 2006 Jan 4;98(1):72-5.

Carbonated soft drinks (CSDs) have been associated with gastroesophageal reflux, an established risk factor for esophageal adenocarcinoma. As both CSD consumption and esophageal adenocarcinoma incidence have sharply increased in recent decades, we examined CSD as a risk factor for esophageal and gastric cancers in a U.S. multicenter, population-based case-control study. Associations between CSD intake and risk were estimated by adjusted odds ratios (ORs), comparing the highest versus lowest quartiles of intake. All statistical tests were two-sided. Contrary to the proposed hypothesis, CSD consumption was inversely associated with esophageal adenocarcinoma risk (highest versus lowest quartiles, OR = 0.47, 95% confidence interval = 0.29 to 0.76; P_{trend} = .005), due primarily to intake of diet CSD. High CSD consumption did not increase risk of any esophageal or gastric cancer subtype in men or women or when analyses were restricted to nonproxy interviews. These findings indicate that CSD consumption (especially diet CSD) is inversely associated with risk of esophageal adenocarcinoma, and thus it is not likely to have contributed to the rising incidence rates.

Ecological study abstract:

Mallath MK. **Rise of esophageal adenocarcinoma in USA is temporally associated with the rise in carbonated soft drink consumption.** Digestive Disease Week Annual Meeting 2004.

BACKGROUND AND AIMS: Incidence rates for adenocarcinoma of the esophagus (ACE) in rose by 570% in American white males in last 25 years and is still continuing to rise. There has been a 40% increase for each 5-year increase in date of birth- a birth cohort effect (El-Serag HB et al. Gut 2002;50:368-372) The reason for this rise remains unexplained. Time-trends in rates of ACE have wide variations world wide. We aimed to identify potential new risk factors that could explain these observations. **METHODS:** US Department of Agriculture (USDA) data was searched for major changes in the diets of Americans in 5 decades. Per capita carbonated soft drinks (CSD) consumption rose by 450% in USA from 10.8 gallons in 1946 to 53 gallons in 2000. Rise in CSD consumption preceded the rise of ACE by 20 years. Temporal trends between 3-year average of per capita consumption of CSD and incidence of ACE were analyzed by linear regression. **RESULTS.** Highly significant correlation was obtained between 3-yearly incidence of ACE (1974-2000) and the 3-yearly per capita consumption of CSD 20 years before (1964-1980); $r=0.99$, 95%CI 0.92-1.0; $p<0.001$ $r^2=0.98$. We found strong biological basis to explain increased dose and duration of exposure to acid: 1. Consumption of 350 ml CSD per day corresponds to 53.5 minutes of pH <4 (Shoenut et al. Dig Dis Sci 1998;43:834-39), and 53 gallons per year would mean 32100 more minutes of acid exposure per year. 2. Excess CSD drinking started in childhood and American teenagers drank 2 cans of CSD per day (USDA) explaining the Birth Cohort Effect. 3. Prevalence of H pylori infection in the population fell during the same period to increase endogenous acid secretion. In general identical time trends were seen worldwide. Countries with per capita CSD below 10 gallons (e.g. East Europe, Japan, China, Taiwan, Korea, India, etc) had little increase in the incidence of ACE. Countries with per capita CSD more than 20 gallons are reporting a rising trend of ACE. Scotland with high rates of ACE over England had a 1.8 times higher consumption of CSD. **CONCLUSION:** The linear association between per capita consumption of CSD 20 years before and the incidence of ACE is very strong. A biological explanation exists for this association, which is seen worldwide. The rising rates may continue for another 20 years. These findings are strong enough to initiate good epidemiological studies to establish the true association between CSD consumption and rates of ACE.
