Artificial Sweeteners and Diabetes

The study’s title is more descriptive, as one might expect: Artificial sweeteners induce glucose intolerance by altering the gut microbiota. The authors (A team led by Eran Elinav of the Weizmann Institute of Science in Rehovot, Israel) studied three noncaloric artificial sweeteners (NAS), saccharin, sucralose, and aspartame. They fed mice that either had a microbiota (bacteria colonizing their gastrointestinal system) or those that were germ free either NAS or control food without NAS. After 11 weeks the mice fed NAS showed signs of glucose intolerance – their blood sugar rose more when challenged with a dose of sugar.

They also found that mice treated with antibiotics did not have this response. Further, they performed fecal transplants from NAS treated mice to germ-free mice and found that the glucose intolerance transferred with the bacteria. They also cultured bacteria with NAS and transplanted that into mice, who then became glucose intolerant.

All of this strongly suggests that consuming NAS alters the gut bacteria, which in turn has an effect of metabolism of the host, leading to glucose intolerance. Glucose intolerance is a risk factor for type II diabetes, which essentially is severe glucose intolerance. The study did not have anything directly to do with obesity.

To see if their results would apply to humans, the researchers fed 7 human subjects NAS and found that 4 of them developed glucose intolerance, just like the mice.

This is all a nice bit of research. It certainly raises some interesting possibilities that deserve follow up study. I don’t, however, think these results are sufficient to recommend ditching NAS, and definitely this research does not suggest that drinking sugary drinks is more healthful than drinks sweetened with NAS.

The scientific community is already starting to pick over the results of this study, and dampen public reaction by putting it into perspective. First, the majority of this work was done in mice, who have a different glucose metabolism, diet, and tolerance than humans. The small study with 7 human subjects is very preliminary, and far from sufficient to conclude that the mice data will be applicable to people.

The Science Magazine article points out that the study was published in a basic science journal, and that a clinical science journal would probably have been much more critical of their clinical speculations.

Another potentially serious criticism is that the researchers combined saccharin, sucralose, and aspartame data. It seems highly unlikely that three very different molecules would all have the same effect on gut microbiota. It’s possible that what the researchers are seeing is isolated to saccharin alone, which the research focused on. Earlier trials used aspartame, which had a smaller effect so the researchers switched to saccharin. The Science Magazine article reports:

“The authors are confounding their conclusions by addressing all these noncaloric artificial sweeteners together,” says Brian Ratcliffe, a nutrition researcher at Robert Gordon University in Aberdeen, U.K. That’s why the title of the paper, “Artificial sweeteners induce glucose intolerance by altering the gut microbiota,” is misleading, he says. “I cannot believe
If this effect is unique to saccharin, that would also explain the disconnect with other data focusing on the consumption of diet soft drinks, which use aspartame and sucralose. A large European epidemiological trial published last year and involving cohorts with >10,000 subjects found an association between drinking sugary drinks and Type II diabetes. It also found an association with drinking NAS containing drinks, but this association vanished when controlled for energy intake and BMI. In other words, people drink diet soda because they are overweight, not the other way around.

A 2011 study of >40,000 men found:

> Sugar-sweetened beverage consumption is associated with a significantly elevated risk of type 2 diabetes, whereas the association between artificially sweetened beverages and type 2 diabetes was largely explained by health status, pre-enrollment weight change, dieting, and body mass index.

The two large epidemiological studies are likely to be more reliable than the 7-subject arm of the recent Nature study.

**Conclusion**

The current study is rigorous and interesting, as far as it goes. It suggests that saccharin has the potential to alter the gut microbiota of mice and has some relationship to glucose metabolism. It would be interesting to work out the various mechanisms involved with future research.

The bottom line that is frequently being communicated to the public about this study, however, is not supported by this data, is misleading, and is likely to lead to poor health decisions.

It is unclear if these results apply to sucralose or aspartame (and therefore diet soft drinks), and it is further unclear if they apply to humans.

Meanwhile, other studies, some of which are massive epidemiological studies, show a clear connection between consuming sugar-sweetened drinks and type II diabetes, and no connection to drinking NAS sweetened drinks. This study should not motivate anyone to abandon their diet drinks for sugar-sweetened drinks, but the way the study is being reported may do just that.