

CARBONATED DRINKS - CAN OF POISON¹ Vanishree. N² Aman P³ Manasa S¹ Professor² Post Graduate student³ Post Graduate student

^{1,2,3} Department of Public Health Dentistry, The Oxford Dental College, Hospital and Research center, Bangalore, India.

ABSTRACT:

In 2007 the worldwide annual consumption of soft drinks reached 552 billion litres, the equivalent of just under 83 litres per person per year, and this is projected to increase to 95 litres per person per year by 2012. Undernutrition and infections had been the major causes of morbidity and mortality in developing countries like India. But today's scenario suggests the emergence of degenerative diseases is likely to be due to overnutrition or obesity. Youngsters consume soft drinks at a breath taking speed. Long term consumption of soft drinks has lead to a number of health issues that have already been, identified including tooth problems, bone demineralization and the development of metabolic syndrome, and diabetes. There was a noticeable preference among the youth for junk foods, aerated beverages and ice creams, as evident from the food frequency pattern. One of the channels used by industry to encourage greater consumption and preferences for soft drinks is schools, fast food centers, etc. But governments around the world are taking action to limit the availability of soft drinks in such places. Policies vary in ways too, presenting an opportunity to study the effects of different policy approaches on short- and long-term consumption and attitudes towards these soft drinks.

Key words: Carbonated Drinks, Systemic Diseases, Dental Erosion, Dental Caries

INTRODUCTION

An addict feels low. His body needs a boost. He reaches into his pocket and finds some money. He slides this money into a vendor machine and a can rolls out. He opens the can guzzles the liquid. He feels his energy return and he knows this energy will last him a couple of hours, enough to keep him alert for the rest of the morning. This addict is a twelve year old and his drug is a soft drink. This addict and thousands like will attend special classes organized in the school, to warn him about the dangers of drugs, tobacco and alcohol. But no one will tell him about the dangers of his favorite drink.¹ Youngsters consume these drinks in breathtaking quantities and are often unaware of the health hazards of the excess consumption. The adverse oral and systemic effects attributed to the consumption of soft drinks are associated with individual ingredients used to formulate the product: soft drinks are merely a vehicle for their delivery. Scientific studies have shown, how as few as one or two soft drinks a day can increase one's risk for numerous health problems like obesity, diabetes, tooth decay, osteoporosis, nutritional deficiencies, heart disease and many neurological disorders.² But still, most of us drink soda. Some drink more than others and probably,

many regular soda drinkers are aware that soft drinks are bad for health. Still, all of us dig out the can of soft drinks one time or the other. The reasons for such a practice could be many-

The taste: The taste could be one thing that gets us addicted to drinking soda, it is delicious. In fact, it is so good, that many people drink it with every meal!

Its everywhere: Even if one wants to drink something else, one will be hard-pressed to find it as prominently displayed in vending machines, at fast-food chains, and supermarket checkouts. We might not realize how ubiquitous cold drinks are in our society until one tries to stop drinking soda.

Promotion and Advertising : Soft drinks are heavily consumed in part because companies promote them vigorously - Billions of dollars are spend on advertising sodas - and market them everywhere - in stores, restaurants, petrol pumps, museums, and even schools.

Thirst: Often people drink soda to quench the thirst. However, this is probably the worst time to drink soda, because when you are very thirsty or dehydrated you have low levels of saliva. And saliva helps to neutralize acids

(soda is the most acidic beverage you can buy) and wash your teeth clean.

Caffeine addiction : Many soft drinks contain caffeine and caffeine is mildly addictive. This fact is part of the reason soda is such a hard habit to break. If you're addicted to the caffeine in soda, you're really having two habits - the soda habit and the caffeine habit³

History

Soft drinks trace their history back to the mineral waters found in natural springs. Ancient societies believed that bathing in natural springs and/or drinking mineral waters could cure many diseases. Among the earliest soft drinks were sherbets developed by Arabic chemists and originally served in the medieval Near East. These were juiced soft drinks made of crushed fruit, herbs, or flowers¹

After 1830, sweetened and flavored (lemon-lime, grape, orange) carbonated drinks became popular. In 1838, Eugene Roussel added a "soda counter" to his Philadelphia shop; by 1891, New York City had more soda fountains than bars².

In 1886, John S. Pemberton, an Atlanta druggist seeking a headache and hangover remedy, added kola nut extract to coca extract and produced Coca-Cola².

Today, heavily sweetened, carbonated drinks, or sodas, are among the most popular beverages in the world. In the last two decades, the introduction of diet drinks containing artificial sweeteners has increased sales of carbonated beverages.⁴

Prevalence

The United States, with less than 5 percent of the world's population, is the largest soda consumer and accounted for one third of total soda consumption in 1999. Americans drink 13.15 billion gallons of carbonated drinks every year. According to the National Soft Drink Association (NSDA), consumption of soft drinks in the United States has doubled for females and tripled for males⁵. Indian non-alcoholic drinks market has seen robust growth over the past few years. It was found that carbonated drinks segment accounted for major chunk of the Indian non-alcoholic drinks market in 2008. Diet coke presently constitutes just 0.7% of the total carbonated beverage market.⁵

The curse of obesity

The prevalence of obesity (defined as BMI \geq 30 kg/m²) in the U.S. nearly doubled from 12.0% in 1991 to 20.9% in 2001. In 2004, 21.7% of the New York City population was obese, compared to 18.2% in 2002. Obesity and excess weight are clear contributors to diabetes, stroke, heart disease, and excess mortality. One study estimated that obesity leads to excess medical costs of \$295/per person per year, similar to the individual contributions of smoking or alcohol consumption to medical costs.⁶

According to another study⁵, each soft drink that a child added to his or her daily consumption was accompanied by an increase in BMI of 0.24 kg/m². Similarly, an 8-year study⁶ of 50,000 female nurses compared women who went from drinking almost no soft drinks to drinking more than one a day to women who went from drinking more than one soft drink a day to drinking almost no soft drinks. The women who increased their consumption of soft drinks gained 8.0 kg over the course of the study while the women who decreased their consumption gained only 2.8 kg. Notably, the increase in soda consumption has mirrored the emergence of obesity as a major public health threat in the U.S.⁵

Reporting in *The Lancet*, a British medical journal, a team of Harvard researchers presented the first evidence linking soft drink consumption to childhood obesity. They found that 12-year-olds who drank soft drinks regularly were more likely to be overweight than those who didn't.⁷

Another dangerous aspect of weight gain is diabetes, because, anything that promotes weight gain increases the risk of diabetes. Drinking soda not only contributes to making people fat, but it also stresses the body's ability to process sugar. Rapidly absorbed carbohydrates like high fructose corn syrup put more strain on insulin-producing cells than other foods. When sugar enters the bloodstream quickly, the pancreas has to secrete large amounts of insulin for the body to process it. Also, insulin itself becomes less effective at processing sugar; a condition contributing to the risk of developing diabetes⁸. Some scientists now suspect that the sweet stuff may help explain why the number of Americans with type 2 diabetes has tripled from 6.6 million in 1980 to 20.8 million today³

Osteoporosis

Frequent consumption of soft drinks may also increase the risk of osteoporosis, especially in people who drink soft drinks instead of calcium-rich milk. High soda consumption in children poses a significant risk factor for impaired calcification of growing bones. In the 1950s, children drank 3 cups of milk for every 1 cup of sugary drinks. Today that ratio is reversed: 3 cups of sugary drinks for every cup of milk. Tellingly, osteoporosis is a major health threat for 44 million Americans. Milk is the principle source of calcium in the typical American diet. Most experts now say that the real culprit is soda's displacement of milk in the diet, though some scientists believe that the acidity of colas may be weakening bones by promoting the loss of calcium.³

Intake of protein and micronutrients is decreased in diets low in dairy products. The resulting diminished calcium intake jeopardizes the accrual of maximal peak bone mass at a critical time in life, adolescence. Nearly 100% of the calcium in the body resides in bone. Nearly 40% of peak bone mass is accumulated during adolescence. Studies suggest that a 5% to 10% deficit in

peak bone mass may result in a 50% greater lifetime prevalence of hip fracture, a problem certain to worsen if steps are not taken to improve calcium intake among adolescents.⁹

The carbonation in all soft drinks causes calcium loss in the bones. This process is as follows-

The carbonation irritates the stomach. The stomach "cures" the irritation the only way it knows how. It adds the only antacid at its disposal: calcium. It gets this from the blood. The blood, now low on calcium, replenishes its supply from the bones. If it did not do this, muscular and brain function would be severely impaired.¹⁰

But, the story doesn't end there. Another problem with most soft drinks is they also contain phosphoric acid (not the same as the carbonation, which is carbon dioxide mixed with the water). This substance also causes a drawdown on the store of calcium. So, soft drinks soften your bones actually, they make them weak and brittle.¹¹

We all know that our average body temperature is about 98.6 degrees F., but how many of us know our normal pH (Power of Hydrogen scale which measures Hydrogen from 0 to 14)? A rating of 7 is neutral. Healthy human bodies should be slightly alkaline at 7.365. Whenever your body moves away from 7.365, your system takes action to move you back to that value.¹¹

The adolescent growth period is a critical time for bone development and it is acknowledged that diet and lifestyle behaviors operating during this period may have important consequences for peak bone mass attainment and future fracture risk. In an observational study of 1335 boys and girls aged 12 and 15 years, higher intakes of carbonated soft drinks (CSDs) were significantly associated with lower bone mineral density at the heel, but only in girls. Owing to the upward trend in CSD intake in adolescence, this finding may be of concern.¹²

Eroded stomach

Soda, no matter who makes it, is the most acidic beverage one can buy, with a pH of about 2.5, about the same as vinegar, but the sugar content disguises the acidity. To put that into perspective, consider that battery acid has a pH of 1 and pure water has a pH level of 7. Throughout the digestive system, that starts from the mouth and ends up at the anus only the stomach can resist an acidic environment up to pH 2.0. But before the acidity of soft drink reaches the stomach it passes through all the other organs involved in the digestive system thus causing an abnormal acidic environment.¹³ The phosphoric acid present in soft drink competes with the hydrochloric acid of the stomach and affects its functions. When the stomach becomes ineffective, food remains undigested causing indigestion, gassiness or bloating (swelling of stomach).³

Carbonated beverages are often viewed as digestive aids because the gas from the carbonation causes distension of the stomach and intestines. This

distension is sensed by the gastrointestinal (GI) system and causes an increase in motility--meaning the food that's in the stomach passes through the GI tract at a faster rate. This may be good for decreasing indigestion but bad for enhancing digestion and absorption of nutrients--particularly amino acids from protein.

If food moves more rapidly through the stomach, there is less time for enzymes to do their work. Also, if fewer enzymes are doing their work, some of the protein you've eaten may not get properly digested.

An interesting fact is that a pH of 4 or above 10 will kill most of the fish and very few animals can tolerate water with a pH below 3 or above 11. With this insight, it is easy to compare the kind of pH tolerated by our stomach. It is generally masked by a number of additives and sugars. This is the reason why everyone enjoys a can of cold drink without realizing the harm done to the stomach.¹³

Caffeine rush

Caffeine, particularly in soft drinks, has become part of mainstream American life as demonstrated by 87% of the general U.S. adult population reporting daily caffeine use (Frary, Johnson, and Wang, 2005. Specifically, the psychoactive properties of caffeine have spawned extensive research that demonstrates that caffeine can be both beneficial and detrimental to individuals. The adverse health effects of caffeine are even more apparent in sensitive populations, namely children and adolescents (McCusker, Goldberger, and Cone, 2006; Pollack and Bright, 2003). High doses of caffeine can cause irritability, restlessness, tension, insomnia, high blood pressure, gastrointestinal disturbance, excessive urination, irregular heartbeat and other side effects.³

One common problem seen over the years, especially in teenagers, is general gastrointestinal (GI) distress, the common complaint being chronic "stomach ache." In almost every case, when one successfully abstains from sodas and caffeine, as these symptoms are caused due to increase stomach acid levels. Drinking sodas, especially on an empty stomach, can upset the fragile acid-alkaline balance of the stomach and other gastric lining, creating a continuous acid environment. This prolonged acid environment can lead to inflammation of the stomach and duodenal lining which becomes quite painful. Over the long term, it can lead to gastric lining erosion.²

Metabolic syndrome

Soft drink consumption is a significant risk factor for developing of metabolic syndrome, a combination of the symptoms such as high blood pressure, obesity, high cholesterol, and insulin resistance.³ Metabolic syndrome is the name given to a series of linked symptoms that are correlated with a higher risk of cardiovascular disease. Drinking one or more carbonated beverages per day was

also correlated with an increase in these symptoms: a 32% higher chance of having low HDL levels; a 31% higher risk of becoming obese; a 30% higher chance of increased waist circumference; and a 25% greater chance of having increased blood triglycerides or fasting hyperglycemia.

A research was conducted as part of the ongoing Framingham Heart Study, a large-scale, multigenerational study that began in 1948 and continues today with the grandchildren of the original participants. Scientists conducted 9,000 "person observations" of middle-aged women and men over a four-year period. Participants who consumed one or more sodas daily were 48 percent more likely to have metabolic syndrome than those who consumed less. Among those who did not begin the study with metabolic syndrome, regular soda drinkers were 44 percent more likely to develop the syndrome than those who drank less than one soda per day.⁴

Teeth in a can

Soda eats up and dissolves the tooth enamel. Researches say that soft drinks are responsible for doubling or tripling the incidence of tooth decay. The acidity can dissolve the mineral content of the enamel, making the teeth weaker, more sensitive, and more susceptible to decay. Soda's acidity makes it even worse for teeth than the solid sugar found in candy.³ Dental erosion is defined as the chemical removal of mineral from the tooth structure. Erosion is classified as extrinsic (i.e., diet) or intrinsic (i.e., gastro-esophageal) in origin. Erosion is typically progressive and results in the wearing away of the exposed tooth surface (i.e., enamel or root surface). Dental caries, on the other hand, is the site-specific acid destruction of tooth surface associated with bacterial fermentation of sugars in the oral cavity.¹²

Dental erosion is considered a significant oral health concern in European and Middle-Eastern countries. Dugmore and Rock reported a tooth erosion prevalence of 59.7% in a random sample of 12-year-old British children from Leicestershire and Rutland counties participating in a National Dental Health survey. Erosion prevalence rates of 34% and 26% have been reported for 5 to 6-year-old and 12 to 14-year-old, respectively, boys in Saudi Arabia. Similar results were reported for 5-year-old Irish school children; 47% exhibited some erosion. In the United States, dental erosion has not been identified as a primary oral health concern in children at this time and similar prevalence rates are not available.¹² European investigators have studied acidic foods and beverages as risk factors for enamel erosion with most investigations focusing on acidic beverages. Larsen et al of Denmark investigated the in vitro erosive potential of soft drinks, mineral waters and orange juices and compared erosion depths to pH and buffering capacity of the beverages. They reported that erosion was minimal in beverages containing a pH above 4.2, but became more evident with pHs decreasing below 4.0. Hunter et al of the United

Kingdom examined the in vitro susceptibility of permanent and deciduous teeth to erosion by soaking extracted teeth in a low pH fruit drink diluted with mineral water.¹²

Now that soft drinks are sold in almost all public and private schools, dentists are noticing a condition in teenagers that used to be found only in the elderly—a complete loss of enamel on the teeth, resulting in yellow teeth. The culprit is phosphoric acid in soft drinks, which causes tooth rot as well as digestive problems and bone loss. Dentists are reporting complete loss of the enamel on the front teeth in teenaged boys and girls who habitually drink sodas. Normally the saliva is slightly alkaline, with a pH of about 7.4. When sodas are sipped throughout the day, as is often the case with teenagers, the phosphoric acid lowers the pH of the saliva to acidic levels. In order to buffer this acidic saliva, and bring the pH level above 7 again, the body pulls calcium ions from the teeth. The result is a very rapid depletion of the enamel coating on the teeth.²

There is a speculate that the dynamics of the erosive potential within the first seconds and minutes of exposure may be critical, since the bulk of a soft drink stays in the mouth for only seconds before being swallowed. After swallowing occurs, the residual amount of liquid in the mouth will be reduced to less than 1 mL (Lagerlöf and Dawes, 1984), leaving only a limited amount of drink in contact with the teeth. Equally important in the mouth are the protective effects of the salivary proteins that also may influence the erosive potential of soft drinks (Zahradnik et al., 1976; Meurman and Frank, 1991). So, as little is known about the erosive potential of soft drinks within the first minutes of exposure to teeth, and about the potentially protective role of salivary proteins, a study conducted by T. Jensdottir et al found that despite the fact that salivary proteins reduced the erosive potential of cola drinks by up to 50%, the erosive potential within the first minutes of exposure was determined solely by the pH of the drink, and the erosive potential was ten-fold higher in cola drinks compared with juices.¹⁴

Despite the alarming situation present in front of the dental professionals, there are not many substantial studies carried out to support the obvious evidence. Recently the National Institutes of Health held a conference on dental decay worldwide. The speakers discussed many possible causes and solutions, but not one mentioned the known effects of phosphoric acid in soft drinks!²

The battle ahead

On August 5th, The Center for Science and Environment (CSE), an activist group in India focused on environmental sustainability issues (specifically the effects of industrialization and economic growth) issued a press release stating: "12 major cold drink brands sold in and around Delhi contain a deadly cocktail of pesticide residues". On July 14, 2005--The Center for Science in the Public Interest, a health advocacy group, is calling for

warning labels on carbonated soft drinks, bans on soft drinks in schools and other measures to reduce consumption of the drinks, especially among kids¹⁵. The American Academy of Pediatrics on Jan. 5 issued a statement calling on schools to eliminate all soft drink sales and encouraging local pediatricians to talk to their school boards about the matter.

All these news indicate that sugar-sweetened beverages are widely believed to be contributing to the growing prevalence of overweight and obesity around the world. One of the channels used by industry to encourage greater consumption and preferences for soft drinks is schools. But governments around the world are taking action to limit the availability of soft drinks in schools. More than 30 national and subnational governmental bodies have made efforts to restrict availability, and the soft drinks industry has also taken some limited voluntary action. Most government-led efforts-with some exceptions-restrict the availability of any drink with added sugar, but the voluntary pledges take less-restrictive approaches.¹⁶ There is little consensus on artificially sweetened drinks. Policies vary in other ways, too, presenting an opportunity to study the effects of different policy approaches on short- and long-term consumption and attitudes. In the meantime, the widespread condemnation of soft drinks in schools suggests that it is within the industry's interests to take more comprehensive action.¹⁷

Move out of the can

There are so many alternatives available, which are not only healthier but also protective for our body. By drinking soda, we cut the intake of fresh fruit juices, milk and tea and even water. As a result we are depriving ourselves from essential minerals and vitamins. These long forgotten nutrient drinks need to be revived by us, if we want our future generation to become free of such alarming ill effects. The presence of carbonated drinks in our life has become so interwoven that we are totally oblivious to any dangers it poses to us and our children. The alarm has been sounded, especially for those who are concerned about the health of their families and those who want to weigh the debilitating consequence of drinking soft drinks. How many more studies and reports are needed before we actually wake up to the lurking danger of carbonated drinks! In 1970's, we were finally able to sit up and confront the dangers of smoking. In the 1990's, the problem of teenage drinking became widely known. The new millennium is the time for waking up to the risk of soda consumption- another drinking problem.

References:

1. Bowman SA. Beverage choices of young females: changes and impact on nutrient intakes. *J Am Diet Assoc.* 2002;102(9):1234-9. [http://dx.doi.org/10.1016/S0002-8223\(02\)90273-7](http://dx.doi.org/10.1016/S0002-8223(02)90273-7)
2. Kishore S, Aggarwal P, Muzammil K.. KAP Study About Carbonated Drinks Among Medical and Nursing Students at Teaching Hospital. Vol. 11 No. 4, Oct-December 2009 [http://www.emedexpert.com/tips/soft-](http://www.emedexpert.com/tips/soft-drinks.shtml)

[drinks.shtml](http://www.encyclopedia.com/doc/1E1-carbonat-bev.html), <http://www.encyclopedia.com/doc/1E1-carbonat-bev.html>

3. Colin D. Rehm, Thomas D. Matte, Gretchen Van Wye, Candace Young, and Thomas R. Frieden. Demographic and Behavioral Factors Associated with Daily Sugar-sweetened Soda Consumption in New York City Adults. *J Urban Health.* 2008 ; 85(3): 375–385. <http://dx.doi.org/10.1007/s11524-008-9269-8> <http://chetday.com/softdrinkdangers.htm>
4. Fiorito LM, Marini M, Mitchell DC, Smiciklas-Wright H, Birch LL Girls' early sweetened carbonated beverage intake predicts different patterns of beverage and nutrient intake across childhood and adolescence. *J Am Diet Assoc.* 2010 Apr;110(4):543-50. <http://dx.doi.org/10.1016/j.jada.2009.12.027>
5. Soft Drinks in Schools Committee on School Health. *PEDIATRICS*,2004;113;1:152-154. <http://dx.doi.org/10.1542/peds.113.1.152>
6. McGartland C, Robson PJ, Murray L, Cran G, Savage MJ, Watkins D, Rooney M, Boreham C. Carbonated Soft Drink Consumption and Bone Mineral Density in Adolescence: The Northern Ireland Young Hearts Project. *Journal of Bone and Mineral Research*, 2003;18;9:1563–1569. <http://dx.doi.org/10.1359/jbmr.2003.18.9.1563>
7. Katherine L Tucker, Kyoko Morita, Ning Qiao, Marian T Hannan, L Adrienne Cupples and Douglas P Kiel Colas, but not other carbonated beverages, are associated with low bone mineral density in older women: The Framingham Osteoporosis Studywomen: The Framingham Osteoporosis Study. *American Journal of Clinical Nutrition*, 2006; 84;4:936-942.
8. Leslie A. Ehlen, Teresa A. Marshall¹, Fang Qian, James S. Wefel and John J. Warren. Acidic beverages increase the risk of in vitro tooth erosion *Nutr Res.* 2008 ; 28(5): 299–303.
9. Jensdottir T, Holbrook P, Nauntofte B, C. Buchlmmmediate. Erosive Potential of Cola Drinks and Orange Juices, *J DENT RES*, 2006; 85: 226 http://www.redorbit.com/news/science/174156/public_interest_group_seeks_warning_labels_in_battle_against_soda
10. Hawkes C. The worldwide battle against soft drinks in schools. *Am J Prev Med*, 2010;38(4):457-61 <http://dx.doi.org/10.1016/j.amepre.2010.01.011>

Corresponding Author

Dr. Vanishree. N,

Professor

Department of Public Health Dentistry,
The oxford dental college, hospital and
research center, Bommanahalli,
Bangalore-560098, Karnataka.

Phone No: 09886145047

Email : vansan25@gmail.com,
chaitu1949@yahoo.co.in.