

**Increased Bottle Water Consumption and Caries Risk Level**

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March 28, 2017

## Abstract

Consumption of bottled water has increased in recent years and there is a concern within the dental community that this consumption increases caries risk. The benefits of community water fluoridation have been successfully documented in the literature in regards to its ability to decrease risk of dental caries. This literature review examines whether the increase in consumption of bottle water impacts exposure to optimal levels of fluoridation and ultimately decreases the reduction in caries rate. Articles selected for this review from PubMed, relating research methodologies for determining caries risk level, in the quest to bring forth a common idea, which can be further explored to clarify the extent of the impact; bottle water has on caries risk level. Because the absence of fluoride in drinking water increases caries risk level, individuals need to be aware of their fluoride consumption to allow the optimal amount to be consumed. When fluoride consumption is reduced, alternative fluoride supplements need to be introduced to maximize the systemic and local effects of fluoride on enamel and on the dentition. Studies indicate a correlation between increased consumption of fluoridated water and dental caries but further studies must be conducted to clarify the correlation. Current studies are limited in the extent of impact bottled water has on caries risk level because of the different modes that patients have of obtaining fluoride from an array of oral hygiene products. Fluoride is easily accessible to patients through oral hygiene products, which makes it challenging to measure the actual impact that bottled water has on caries risk level. Bottled water companies should be mandated to add fluoride to their products to reduce caries, or label bottles so that individuals can have the fluoride option. These initial findings suggest that further research and education need to be done in the area.

Community water fluoridation programs have been successful in assisting in the prevention of dental caries in the US by helping teeth to stay stronger,<sup>1</sup> resulting, in fact, in “35% reductions in caries in primary teeth and a 26% reduction in permanent teeth.”<sup>2</sup> The widespread success of community water fluoridation programs has earned its place as one of the top ten great public health achievements of the 20th century, according to the Center for Diseases Control and Prevention.<sup>1(p151)</sup> However, the rise in consumption of bottled water in the US in recent years<sup>4</sup> has led to the examination of how this consumption impacts caries risk. A secondary question is how much fluoride is naturally in bottled water, if any. Evidence suggests that with the increase in bottled water consumption, there is a marked reduction in the consumption of fluoridated public drinking water, reducing the caries prevention benefits of fluorinated water.<sup>3</sup> Evaluating the consumption of bottled water and its impact on caries risk in the pediatric population will help to determine if mandates should be established for fluoride to be added to bottled water.<sup>4</sup> The research that connects bottled water consumption with different populations and the impact fluoride has on caries risk will be evaluated to determine the necessity of adding fluoride to bottled water.<sup>5(p310)</sup> The increasing consumption of bottled water in the US causes a reduction in fluoridated drinking water consumption, leading to an increased risk for caries; consequently, bottle water companies should be mandated to add fluoride to bottled water to reduce caries risk.

The prevention of dental caries resulting from community water fluoridation programs has been extensively documented in scientific research. Water fluoridation has been shown to be efficient in the prevention of the demineralization of tooth. Community

water fluoridation programs are especially important in the pediatric patients population because these programs aid in reducing the risk of caries. Dental caries are the most prevalent childhood disease,<sup>3(p474)</sup> yet also one of the most preventable childhood diseases.<sup>5(p310)</sup> According to a 2010 survey, community water fluoridation programs are present in “66 percent of U.S. households.”<sup>3(p474)</sup> In community water fluoridation programs, fluoride concentration ranges from 0.7 to 1.2 ppm of fluoride depending on the natural fluoride concentration in water.<sup>3(p474)</sup> Fluorinated drinking water has been reported to help “reduce caries by 55 to 60 percent in the early years of its implementation in the United States.”<sup>3(p474)</sup> A study that examined lifelong fluoride exposure in two towns, compared Australia’s Townsville, a fluoridated drinking water town, and Brisbane a nonfluorinated drinking water town to evaluate the correlation. The study showed that six-year-old children with 100% lifetime exposure to optimally fluoridated water had a caries index dmfs (decayed, missing, and filled teeth) score of 36% lower than children with no exposure to fluoridated water. This statistic was even lower for teenagers in the same exposure situation.<sup>6(p287)</sup> Thus the importance of community water fluoridation programs has proven to have a remarkable impact on decreasing caries risk level. However, the increasing rate of people consuming nonfluorinated-bottled water has led to a decrease in the benefits of community fluorinated water programs.

Bottled water consumption in the US increased “from 13.5 gallons per capita US consumption in 1997 to 29.3 in 2007”, and the trend has continued in recent years.<sup>5 (p 310)</sup> Consumption of bottled water varies depending on economic status, beverage preference

and water acceptability. In a recent US study, 30% of the participants consumed bottled water as a substitute for other carbonated and sweet bottled beverages and not necessarily to replace public drinking water.<sup>6(p284)</sup> In recent years, it has come to light that fluoride concentration varies drastically from one bottling distributor to the next because of the lack of regulation and because the level of naturally occurring fluoride varies, depending on the location of the bottling facility. “An investigation of sixty-five bottled waters revealed that only 12% contained an optimal level of fluoride and only 5% listed fluoride content on their labels.”<sup>5(p 310)</sup> The discrepancy between fluoride concentration in bottled water companies leads to consumers not having a clear understanding of their fluoride consumption, resulting in under consumption of the recommended dose to prevent dental caries. Because patients are unclear of the level of fluoride in bottled water they may also be unaware of the need to compensate using other fluoride treatments like fluoridated toothpaste, mouthwashes, fluoridated varnishes and gel treatments to increase their fluoride contact with tooth surfaces and to reduce caries risk.

Studies have evaluated the correlation between the consumption of fluorinated drinking water and bottled water consumption. This correlation has shown that even though there could be a reduction in fluoride in bottled water, which can lead to an increased risk for dental caries, other factors including economic status, water preference, tooth surface, and oral health are also involved in determining caries risk level. The research evaluated the different demographics that consume bottled water and found that reasons for consumption of bottled waters varies in regards to “fear of contaminants in tap water (46%); taste and/or smell of tap water (27%); and convenience of bottled water

(26%).”<sup>5(p 312)</sup> Social economical levels, education, and race were evaluated in multiple studies but no significant correlation was determined. Studies also reviewed the impact the type of water consumed had on the various tooth surfaces and caries present and found that “bottled water users had somewhat higher caries prevalence and incidence on the pit and fissure surfaces, slightly lower rates for smooth surfaces”.<sup>1(p153)</sup> Even though these findings have some significance in regards to caries risk levels, further research is needed to evaluate other factors that are involved in the possible reduction of fluoride exposure from the consumption of bottled drinking water. Bottle water companies need to offer both fluoridated and nonfluoridated water. Although from country to country fluoride concentrations can vary, in the US, more than twenty companies produce water with optimum fluoride concentrations.<sup>6(p 295)</sup> Further regulation on fluoride content in bottled beverages needs to be developed, which will allow consumers to have a clearer understanding of fluoride consumption.

From the review of research, a negative correlation can be found between the consumption of bottled water and the amount of fluoride exposure. The presence of fluoride in water consumption has been shown to reduce a patient's caries risk level in the prevention of developing caries, while drinking nonfluoridated bottled water may increases risk. Patient education is the key to preventing increases in caries risk level caused by the reduction of consumption of fluoridated water. It can be concluded that the increase in the consumption of bottled water reduces the patient's overall fluoride consumption. For patients to properly determine their fluoride consumption in the quest to maximize its benefits and to decrease the caries risk level, bottled water distributors

need to be mandated to document the concentration of fluoride in their products. This practice will allow consumers to have the option to consume fluoridated bottled water or not. The Food and Drug Administration has mandated the indication of vitamins and minerals in food product labels for many years. This mandate sets precedent for future mandates involving fluoride in bottled beverages. Until further regulation is made on bottled water, dental professionals need to educate patients on the importance of obtaining the ideal concentration of fluoride. If patients have the choice to consume nonfluorinated bottle water, dental professionals need to educate patients on alternative means of obtaining the beneficial amount of fluoride to maximize the prevention of developing caries. Until fluoride concentration of bottled water is regulated and represented on the label, consumers of bottled water are very likely decreasing their consumption of fluoride.

## References:

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