



The hidden truths behind the bottled water, sports drink, and energy drink market and the threat they pose to the oral cavity

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Abstract

This course will discuss the changing landscape of American beverage choices. Bottled water, sports drinks, and energy drinks are increasing in sales each year. People have misconceptions that these beverages are healthier alternatives to traditional sodas; however, many of these substances pose a risk to the oral environment with their acidic nature and sugar content. The dental professional is in a key position to ensure patients are adequately informed of the risks versus benefits of their beverage choices. This course will discuss popular beverage choices and arm the dental professional with the knowledge needed to educate patients on their beverage choices.

Educational objectives

At the conclusion of this course, the reader will be able to:

1. Understand the caries process as it relates to extrinsic acid attacks
2. Differentiate between bottled water, sports drinks, and energy drink contents
3. Be familiar with the oral implications associated with beverage choices and provide interventions to promote remineralization and a homeostatic oral pH
4. Be better equipped to educate patients on the risks of beverage choices as related to the dental caries process



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The American diet is rich in acidic choices, especially with the growing market of bottled beverages. Many of these products are advertised as healthier alternatives to sodas, but their oral implications are significant considering their pH content. This course will provide a brief overview of the caries process focusing on the effects extrinsic acids have on hard tissues. The pH of the oral cavity as compared to the pH of common beverages such as bottled water, sports drinks, and energy drinks will be presented. Then statistics, regulations, contents, definitions, and safety concerns of these beverages will be discussed.

Extrinsic acids attack oral hard tissues and lead to destructive processes. Healthy saliva pH ranges from 6.8 to 7.4. When the pH of the mouth is altered to a more acidic state, the natural balance of protective versus pathological factors shifts, increasing the risk for demineralization and dental caries. The American Dental Association publishes caries risk assessment forms on their website and lists sugary drinks (including juice, carbonated or noncarbonated soft drinks, and energy drinks) as a high-risk potential for patients.¹ Dental providers need to question patients on their ingestion of these beverages and then alter oral hygiene instructions and treatment plans accordingly.

Caries overview

Dental caries is a preventable disease that has reached epidemic levels in the United States.² It is considered one of the most common childhood diseases.² According to the Centers for Disease Control and Prevention (CDC), 37% of children ages 2-8 experienced dental caries in their primary teeth, and 14% had untreated tooth decay in 2011-2012. During this same time period, 58% of adolescents ages 12-19 had dental decay in permanent teeth and 15% had untreated decay.² Ninety-two percent of adults ages 20-64 and 89% of adults ages 65 and older had dental caries in their permanent teeth.³ Dental caries is a public health concern, and the cost of treating this disease is draining on the economy, especially since approximately only 50% of Americans have some form of dental insurance (private or public).⁴ In 2017, Americans paid out-of-pocket for 47.1% of all dental expenditures.⁴ Aside

from the economic impact, the treatment and prevention of caries is a complicated process for providers due to the nature of the disease.

Dental caries is a multifactorial process that involves destruction and alteration of the hard tissues of the mouth. It is through the process of demineralization that the caries process initiates, and acidic food and beverages play an important role in this process. Demineralization is a process by which the minerals of tooth structures are dissolved.⁵ This course focuses on the effects of extrinsic acid introduction to the mouth and its role in the demineralization process.

Three important structures essential to the discussion of dental caries are enamel, dentin, and cementum. Enamel is a highly calcified/mineralized structure at 95% and consists of many elements such as hydroxyapatite, calcium, fluoride, and phosphate. Dentin is the next highest calcified structure at 70%, and cementum is 65% calcified.⁶ The higher the calcification, the more resistant the structure is to extrinsic acid attacks from food and beverages bathing the hard tissues.

The pH scale is used to define how acidic or basic a substance is. pH stands for the "power of hydrogen," and the scale range is 1-14. The number 1 indicates a substance that is highly acidic (more H⁺ ions) and 14 is a basic substance (lower concentration of H⁺ ions). The critical pH for enamel is 4.4-5.5 and the critical pH for cementum is 6.0-7.0.⁵ This is the pH value at which demineralization of hard tissues is likely to occur. When critical pH is reached, calcium and phosphate ions dissolve out of the tooth first, followed by hydroxyapatite and fluorapatite.⁵ With the assistance of bacteria such as *Streptococcus mutans* and *Lactobacillus*, a cavity will form. Apatite solubility increases tenfold when the pH drops to 3.0, and when the pH drops to 2.0, apatite solubility approaches 1,000 g/L.⁷

It is important for dental health providers to remember that hard tissues can remineralize under the right conditions with the assistance of calcium, phosphate, and fluoride, and that proper recommendations need to be made for patients when destructive processes are occurring. The last section of this course will focus on the commercially available products dental

providers can utilize in the management of pH and dental caries.

As part of a successful caries management plan, dental professionals need to educate patients on the dangers of a high acid intake and discuss beverage choices that can put the mouth in a critical pH environment. Table 1 lists common beverages in the American diet along with their respective pH value ranges. You will notice many common drinks have pH levels conducive to apatite solubility.⁷ For example, common beverages such as wine, beer, and coffee are acidic in nature. In the next sections, the pH values of bottled water, sports drinks, and energy drinks will be discussed, and you will notice these beverages have pH values that are also in the critical range for hard tissue dissolution.

TABLE 1: pH ranges for common beverages⁷

2.0-3.0 pH	Lemon juice, cola
2.3-3.8 pH	Wine
2.4-3.8 pH	Coffee
3.0-4.0 pH	Orange juice, iced tea, white wine, lemon-lime soda
4.0-5.0 pH	Black tea, beer, carrot juice
6.0-7.0 pH	Milk: skim and flavored
7.0+ pH	Whole milk

Bottled water

Bottled water is the fastest growing drink choice in the United States. Sales soared in 2015 with increases from 6.5 to 11.4%.⁸ Bottled water sales surpassed that of soda sales for the first time in 2016.⁹ Total volume sold grew 1 billion dollars in 2015, which equated to 9% annual sales growth. In 2016, sales grew another 7.4%, topping out at 16 billion wholesale dollars.⁹ The public increase in sales is attributed to many factors such as people seeing it as a healthy substitute to other packaged beverages and tap water, as well as its quality of taste over tap water.⁹

The Environmental Protection Agency (EPA) and the Food and Drug Administration (FDA) set drinking standards for bottle water. Only 1% of bottled water is imported, with the vast majority being sourced in the US.^{8,9} The EPA states that "carbonated water, soda water, seltzer water, sparkling water,

and tonic water are considered soft drinks and are not regulated as bottled water.⁸

A dental concern to this rise in bottled water consumption among the American public is related to the pH values for individual products. In a peer review publication from the Journal of Dental Hygiene in 2015, 10 out of 14 bottled waters tested acidic on the pH scale.¹⁰ The results are listed in Table 2 with more acidic products in red and more basic products in blue based on healthy saliva pH values.

Dental professionals should educate their patients on these results and the oral implications to ingesting acidic beverages throughout the day. If the public perception is that bottled water is a healthier alternative to other beverages, then discussing the acid content of these products needs to be an important piece of oral hygiene instruction. As listed in Table 2, the pH of city tap water varies by area, and oral health professionals should become familiar with the pH of their city's tap water when educating patients.

TABLE 2: pH values of common bottled water brands¹⁰

2.49	Vitamin Water
5.16	Ozarka
5.63	Aquafina
5.72	Dasani
6.24	Evian
6.9	Fiji
6.91	Smart Water
7.29	Average for house tap water (pH varies from city to city)
8.78	Evamor
10.38	Essentia

Sports drinks

Table 3 lists popular commercially available sports drinks sold in the United States.⁷ Take notice of the acidic pH values of these substances. Sports drinks are advertised to rehydrate the body after exercise. They can contain multiple ingredients and commonly contain glucose, chloride, calcium, magnesium, sodium, potassium, carbohydrates, antioxidants, and electrolytes. Their effects are to replace lost electrolytes and carbohydrates during sustained strenuous

TABLE 3: pH values for popular U.S. sports drinks⁷

2.73-2.93	Powerade
2.97-3.17	Gatorade
2.98-3.65	Vitamin Water
3.01-3.17	Propel
3.15-3.53	Sobe

exercise and prevent dehydration.¹¹ Since sport drink consumption continues to rise each year in the United States by over 1.5 billion dollars, dental providers are likely to encounter patients consuming these beverages and will need to provide education on the effects extrinsic acids can have on oral hard tissues.¹²

Energy drinks

An energy drink is defined as any beverage that contains a variety of substances such as caffeine (CNS stimulant), sugars, sweeteners, guarana (South American plant that contains large amounts of caffeine and small amounts of theobromine, theophylline, and tannins), taurine (antioxidant), L-carnitine (antioxidant), kola nut, yerba mate, cocoa, ginseng (East Asian herb), carnitine, yohimbine (alkaloid found in plants), glucuronolactone, and/or vitamins.^{11,13} The main active ingredient is caffeine. They are legal stimulants marketed to increase alertness, attention, concentration, energy, stamina, and athletic performance.^{11,13} Unfortunately, these drinks can produce undesirable physiological effects. They can increase heart rate, blood pressure, breathing rate, and contribute to adverse CNS effects.^{11,13} According to the United States Department of Health and Human Services, "next to multivitamins, energy drinks are the most popular dietary supplement consumed by American teens and young adults."¹² Energy drinks are packaged in two different forms: 16-ounce bottles or 2-2.5-ounce energy shots. The caffeine range for 16-ounce bottles is 70-240 mg. The caffeine range in an energy shot is 113-200 mg. By comparison, the caffeine amount in sodas is 35 mg and 100 mg in a cup of coffee.¹²

The FDA limits caffeine content to 71 mg per 12 ounces of drink.¹¹ However, energy drinks are categorized as food, and as such, the caffeine amounts are unregulated.¹¹

When a product contains a plant extract such as guarana, manufacturers are not required to list the caffeine it contains. Thus, the actual caffeine in a serving may exceed what is listed on the product label.¹¹ Energy drink manufacturers can also claim their product is a "natural dietary supplement," and then they are exempt from testing, warning labels, or restrictions against the sale or consumption by minors.^{14,15}

Energy drinks are sold in over 140 countries, and while it is a small component of the nonalcoholic beverage industry, it had extremely dramatic growth by 60% from 2008 to 2012.^{11,16} In 2012, total US sales for the energy drink and shot market was worth over 12.5 billion dollars and projected to grow to 21.5 billion dollars by 2017.¹⁶ According to the United States Department of Health and Human Services, "men between the ages of 18 and 34 years consume the most energy drinks, and almost one-third of teens between 12 and 17 years drink them regularly."¹² Children, adolescents, and young adults make up half the market of energy drink sales and it is reported that 30-50% of adolescents and young adults in the United States consume energy drinks.¹¹

One United States survey conducted on 496 college students in 2007 found that 51% consumed one energy drink per week, and the majority consumed energy drinks several times a week.¹⁷ In this study, 54% of the respondents reported mixing energy drinks with alcohol, which has brought about additional public safety concerns.¹⁷ People may not be able to tell how intoxicated they are and may feel less intoxicated than they truly are when they mix energy drinks with alcohol.¹⁷ In 2011, 42% of all energy drink-related emergency department visits involved combining these beverages with alcohol or drugs.¹² The CDC reported in 2017 that 10.6% of students in grades 8-12 and 31.8% of adults 19-28 years of age reported consuming alcohol mixed with an energy drink at least once in the past year.¹⁸

Of additional concern for dental professionals, as it relates to caries, is the amount of sugar in these beverages. One 16-ounce energy drink may contain 54-62 grams of sugar, which exceeds the maximum amount of sugars recommended for an entire day.¹² Energy drinks have no therapeutic benefits

and many ingredients are understudied and not regulated.¹¹ The American Academy of Pediatrics recommends that adolescents do not consume energy drinks and children 12-18 years of age should not exceed 100 mg of caffeine per day.¹⁸⁻²⁰ Children younger than 12 years of age should not consume any caffeine. According to the CDC, “in 2007, 1,145 adolescents aged 12 to 17 went to the emergency room for an energy drink related emergency, in 2011 that number climbed to 1,499.”¹³ Of the 5,448 US caffeine overdoses reported in 2007, 46% occurred in those younger than 19 years.¹¹ Heavy consumption of caffeine can lead to insomnia, seizures, mania, anxiety, dehydration, digestive problems, irregular heart beat and blood pressure, stroke, and even sudden death.^{11,19}

TABLE 4: pH values of popular energy drinks²¹

2.47-3.14	Jolt
2.70-3.58	Monster
2.74-3.16	Rockstar
2.79-2.86	Amp Energy
2.81-2.82	5 Hour Energy
3.07	CliffShot Electrolite
3.08-3.10	Full Throttle
3.25-3.43	Red Bull
3.27-3.32	NOS
3.79	Cytomax
3.86	Accelerade

The pH of many commercially available and popular energy drinks are listed in Table 4.²¹ You will notice that all of these energy drinks have a pH value well below the critical pH for enamel and cemental dissolution and apatite solubility. The ranges of pH values are mostly dependent on the flavoring and sugar content of the product.

Patient education

Dental professionals should educate their patients on the acid content of the beverages discussed in this course. Frequent acid attacks will lead to the demineralization and dissolution of hard tissues in the mouth. Patients should be advised to consume these acidic beverages in a short time span and not sip on them throughout

the day. Patients should also be advised not to brush their teeth right after an acid exposure, but wait 40-45 minutes to allow the mouth to adjust back to a healthy pH level.⁵

Additional preventive agents should be recommended based on a patient’s risk assessment for dental caries. Agents that contain fluoride, calcium, and phosphate are available in both over-the-counter and prescription formulations in the United States. According to a systematic review published in the Journal of the American Dental Association, an expert panel found that 38% silver diamine fluoride, dental sealants, 5% sodium fluoride varnish, 1.23% acidulated phosphate fluoride gel, and 5,000 parts per million sodium fluoride toothpaste or gel are the most effective interventions for dental caries.²² Additionally, the panel stated that no other potassium or calcium products should be used as a substitute for other fluoride products when patients present with caries risk.²² However, these products do have the ability to alter the pH of the oral cavity and are used in the management of caries and dentinal hypersensitivity.

Amorphous calcium phosphate (ACP) is a reactive calcium phosphate compound that releases calcium and phosphate ions into the irregularities of enamel in order to assist in the formation of apatite.^{23,24} The disadvantage of ACP is that it is not bioavailable after the product is rinsed away and has high solubility and low substantivity.^{23,24} The challenges of ACP resulted in the development of carriers that work to stabilize calcium and phosphate ions in amorphous form. Casein phosphopeptide (CPP) is a sticky, milk protein that can stabilize ACP by binding directly to enamel pellicle and plaque.^{5,24} CPP-ACP provides a reservoir of bioavailable calcium and phosphate in the saliva and at the surface of the tooth.²⁵ During acidic challenges, ACP is released from the CPP complex.²⁴

Calcium sodium phosphosilicate (NovaMin) contains calcium, phosphorous, sodium, and silica.²⁵ When introduced to the oral environment, it reacts with saliva to provide a twofold action. First, it buffers acidic pH, and second, it deposits calcium and phosphate ions into demineralized areas to form new layers of hydroxyapatite crystals.²⁵

NovaMin is available in prophylaxis pastes that can be applied by dental professionals.

Dental sealants can also help prevent or arrest decay in the pits and fissures of teeth as reported by a peer-review publication in the Journal of the American Dental Association.²⁶ When placed properly, sealants provide a physical barrier from acid challenges.²⁵ Fluoride-releasing sealants have been shown to arrest caries progression in incipient demineralized lesions.⁵

When extrinsic acid attacks are a frequent issue for a patient, dental professionals may want to recommend buffering agents such as sodium bicarbonate or desensitizing agents. Arginine products are available in the US and have a role in stabilizing pH. Arginine is an amino acid naturally found in saliva that can contribute to pH homeostasis of the mouth through its metabolism and production of ammonia, a byproduct.²⁷

Evidence shows that saliva has the ability to buffer pH after acid attacks as well as reverse the demineralization process.^{28,29} The results of a systematic review in 2019 found that “if there is an increase in pH, buffering capacity, and flow, there is a decreased caries incidence. Thick, sticky, and frothy saliva with an increased viscosity makes the tooth more susceptible to caries.”²⁹

When saliva flow rate and function are adequate, saliva has the ability to buffer the pH after an extrinsic acid attack.²⁸ Saliva collection kits are commercially available to determine a patient’s saliva buffering capacity in resting and/or stimulated states.³⁰ This can be used as part of an overall caries risk assessment and enhance patient treatment plans and recommendations, and provide early detection/intervention. For example, if a patient has a high buffering capacity, attempts can be made to remineralize lesions before providing surgical interventions.³¹ For a patient with low buffering capacity, surgical interventions may be the best option to avoid further gross destruction of teeth.³¹

All dental professionals should use their best clinical judgment in making recommendations to individual patients. All recommendations should be made using evidence-based research that is supported by the American Dental Association.

Conclusion

Dental caries is a preventable disease that has reached epidemic levels in the United States. The increased sales and consumption of bottled water, sports drinks, and energy drinks are adding to this public health crisis. Teeth that are subjected to chronic acid attacks throughout the day are at increased risk for demineralization and dental caries. Since people view these beverages as healthy alternatives to tap water and sodas, dental professionals must educate their patients and the general public on the adverse oral effects of bathing hard tissues in extrinsic acidic substances.

REFERENCES

- American Dental Association. Caries Risk Assessment Form (Age >6). http://www.ada.org/~media/ADA/Science%20and%20Research/Files/topic_caries_over6.ashx
- Dye BA, Thornton-Evans G, Li X, Iafolla TJ. Dental caries and sealant prevalence in children and adolescents in the United States, 2011-2012. Centers for Disease Control and Prevention National Center for Health Statistics. Data Brief No. 191. March 2015. <https://www.cdc.gov/nchs/data/databriefs/db191.pdf>
- National Institute of Dental and Craniofacial Research. Dental caries (tooth decay) in adults (age 20 to 64). July 2018. <https://www.nidcr.nih.gov/research/data-statistics/dental-caries/adults>
- Centers for Medicare and Medicaid Services. National Health Expenditure Data. <http://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData/NationalHealthAccountsHistorical.html>
- Wilkins E. *Clinical Practice of the Dental Hygienist*. 12th ed. 2017. Wolters Kluwer. Philadelphia.
- Scheid R, Weiss G. *Woelfel's Dental Anatomy*. 9th ed. 2017. Wolters Kluwer. Philadelphia
- Reddy A, Norris DF, Momeni SS, Waldo B, Ruby JD. The pH of beverages available to the American consumer. *J Am Dent Assoc*. 2016 Apr;147(4):255-263.
- United States Environmental Protection Agency. Water Health Series: Bottled Water Basics. 2005. https://www.epa.gov/sites/production/files/2015-11/documents/2005_09_14_faq_fs_healthseries_bottledwater.pdf
- International Bottled Water Association. Bottled Water Market. 2019. <https://www.bottledwater.org/economics/bottled-water-market>
- Wright KF. Is your drinking water acidic? A comparison of the varied pH of popular bottled waters. *J Dent Hyg*. 2015 Jun;89 Suppl 2:6-12.
- Seifert SM, Schaechter JL, Hershorin ER, Lipshultz SE. Health effects of energy drinks on children, adolescents, and young adults. *Pediatrics*. 2011 Mar;127(3):511-528. doi: 10.1542/peds.2009-3592
- National Institutes of Health. National Center for Complementary and Integrative Health. Energy Drinks. July 26, 2018. <https://nccih.nih.gov/health/energy-drinks>
- Centers for Disease Control and Prevention. CDC Healthy Schools. The buzz on energy drinks. March 22, 2016. <https://www.cdc.gov/healthyschools/nutrition/energy.htm>
- Lee J. Energy drinks vs. sports drinks: know thy difference. July 9, 2009. <http://speedendurance.com/2009/07/09/energy-drinks-vs-sports-drinks-know-thy-difference>
- McCarthy M. Overuse of energy drinks worries health pros. *USA Today*. July 3, 2009. <https://www.buffalo.edu/content/dam/www/news/imported/pdf/July09/USATodayMillerEnergyDrinks.pdf>
- Packaged Facts. Energy drinks and shots: U.S. market trends. Jan. 29, 2013. <https://www.packagedfacts.com/Energy-Drinks-Shots-7124908/>
- Malinauskas BM, Aeby VG, Overton RF, Carpenter-Aeby T, Barber-Heidal K. A survey of energy drink consumption patterns among college students. *Nutr J*. 2007 Oct;6:35. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC111861475-2891-6-35>
- Centers for Disease Control and Prevention. Alcohol and Public Health. Fact Sheets: Alcohol and Caffeine. October 23, 2018. <https://www.cdc.gov/alcohol/fact-sheets/caffeine-and-alcohol.htm>
- Babu KM, Church RJ, Lewander W. Energy drinks: the new eye-opener for adolescents. *Clin Pediatr Emerg Med*. 2008 Mar; 9(1):35-42. doi: 10.1016/j.cpem.2007.12.002
- Heatherley SV, Hancock KMF, Rogers PJ. Psychostimulant and other effects of caffeine in 9- to 11-year-old children. *J Child Psychol Psychiatry*. 2006 Feb;47(2):135-142. doi: 10.1111/j.1469-7610.2005.01457
- Jain P, Nihill P, Sobkowski J, Agustin MZ. Commercial soft drinks: pH and in vitro dissolution of enamel. *Gen Dent*. 2007 Mar-Apr; 55(2):150-154.
- Slayton RL, Urquhart O, Araujo MWB, et al. Evidence-based clinical practice guideline on nonrestorative treatment for carious lesions: A report from the American Dental Association. *J Am Dent Assoc*. 2018 Oct;149(10): 837-849. doi: 10.1016/j.adaj.2018.07.002
- Tung MS, Eichmiller FC. Amorphous calcium phosphates for tooth mineralization. *Compend Contin Educ Dent*. 2004 Sep;25(9 Suppl 1):9-3.
- Gurunathan D, Somasundaram S, Kumar SA. Casein phosphopeptides-amorphous calcium phosphate: A demineralizing agent of enamel. *Aust Dent J*. 2012;57:404-408. doi: 10.1111/adj.12006
- John MK, Babu A, Gopinathan AS. Incipient caries: an early intervention approach. *Int J Community Med Public Health*. 2015 2(1):10-14. doi: 10.5455/2394-6040.ijcmph20150203
- Wright JT, Tampi MP, Graham L, et al. Sealants for preventing and arresting pit-and-fissure occlusal caries in primary and permanent molars. A systematic review of randomized controlled trials—a report of the American Dental Association and the American Academy of Pediatric Dentistry. *J Am Dent Assoc*. 2016 Aug;147(8):631-645. doi:10.1016/j.adaj.2016.06.003
- Nascimento MM. Potential uses of arginine in dentistry. *Adv Dent Res*. 2018 Jan; 29(1):98-103. doi: 10.1177/0022034517735294
- Gopinath VK, Arzreanne AR. Saliva as a diagnostic tool for assessment of dental caries. *Arch Orofac Sci*. 2006 1:57-59.
- Hegde MN, Attavar SH, Shetty N, Hegde ND, Hegde NN. Saliva as a biomarker for dental caries: A systematic review. *J Conserv Dent*. 2019 22(1):2-6.
- Moritsuka M, Kitasako Y, Burrow MF, Ikeda M, Tagami J. The pH change after HCl titration into resting and stimulated saliva for a buffering capacity test. *Aust Dent J*. 2006 Jun;51(2):170-174.
- Mjör IA, Dahl JE, Moorhead JE. Age of restorations at replacement in permanent teeth in general dental practice. *Acta Odontol Scand*. 2000 Jun;58(3):97-101.



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QUESTIONS

1. What is the pH range for healthy saliva?
 - A. 5.5-6.0
 - B. 6.5-6.8
 - C. 6.8-7.4
 - D. 7.4-7.8
2. What percentage of children ages 2-8 experienced decay in 2011-2012?
 - A. 12%
 - B. 37%
 - C. 55%
 - D. 92%
3. What percentage of adults ages 20-64 experienced decay in 2011-2012?
 - A. 12%
 - B. 37%
 - C. 55%
 - D. 92%
4. What percentage of dental expenditures did Americans pay out-of-pocket in 2017?
 - A. 12%
 - B. 14%
 - C. 22%
 - D. 47.1%
5. Which is described as a highly calcified/mineralized structure at 95% and consists of many elements such as hydroxyapatite, calcium, fluoride, and phosphate?
 - A. Enamel
 - B. Dentin
 - C. Cementum
 - D. None of the above
6. What is the percentage of calcification of cementum?
 - A. 90%
 - B. 75%
 - C. 65%
 - D. 45%
7. What is the critical pH for enamel demineralization?
 - A. 4.0-5.0
 - B. 4.5-5.5
 - C. 5.0-6.0
 - D. 6.0-7.0
8. What is the critical pH for cementum demineralization?
 - A. 4.0-5.0
 - B. 4.5-5.5
 - C. 5.0-6.0
 - D. 6.0-7.0
9. When demineralization occurs, which structure dissolves last?
 - A. Calcium
 - B. Phosphate
 - C. Hydroxyapatite
 - D. Fluorapatite
10. What was the wholesale dollars of sales for bottled water in 2016?
 - A. 2 million
 - B. 6 million
 - C. 16 million
 - D. 16 billion
11. What agency/agencies set the drinking standards for bottled water in the US?
 - A. EPA
 - B. FDA
 - C. OSHA
 - D. Both a & b
12. What is the pH value for Dasani water?
 - A. 5.0
 - B. 5.72
 - C. 6.2
 - D. 7.0
13. What is the average pH of tap water?
 - A. 3.3
 - B. 5.0
 - C. 6.2
 - D. 7.29
14. Which product is marketed to rehydrate the body after exercise and commonly contains glucose, carbohydrates, and electrolytes?
 - A. Bottled water
 - B. Sports drinks
 - C. Energy drinks
 - D. None of the above
15. Which product has caffeine as its main ingredient and additional ingredients such as guana, ginseng, and taurine?
 - A. Bottled water
 - B. Sports drinks
 - C. Energy drinks
 - D. None of the above
16. Which is a side effect that has been observed in people who consume energy drinks?
 - A. Increased heart rate
 - B. Increased blood pressure
 - C. Increased breathing rate
 - D. All of the above
17. What was the sales growth of the energy drink market in 2008-2012?
 - A. 25%
 - B. 30%
 - C. 35%
 - D. 60%

ONLINE COMPLETION

Take this test online for immediate credit. Go to dentalacademyofce.com and log in. If you do not have an account, sign up using enrollment key **DACE2019**. Then, find this course by searching for the title or the quick access code. Next, select the course by clicking the "ENROLL" option. Continue by pressing "Start." After you have read the course, you may take the exam. Search for the course again and place the exam in your cart. Check out, take the exam, and receive your credit!

QUESTIONS

18. What is the caffeine range for energy drinks?
- 22-52 mg
 - 51-72 mg
 - 71-100 mg
 - 113-200 mg
19. What mg dose does the FDA set as the limit of caffeine in beverages?
- 38 mg
 - 55 mg
 - 62 mg
 - 71 mg
20. Who are the largest consumers of energy drinks in the US?
- Men ages 30-45
 - Men ages 18-34
 - Women ages 30-45
 - Women ages 18-34
21. What percentage of children ages 12-17 drink energy drinks on a regular basis?
- 1/3
 - 1/4
 - 1/2
 - 1/6
22. In 2011, what percentage of all energy drink-related emergency department visits involved combining energy drinks with alcohol or drugs?
- 12%
 - 18%
 - 22%
 - 42%
23. How many grams of sugar are contained in one 16-ounce energy drink?
- 10-12 g
 - 20-25 g
 - 25-35 g
 - 54-62 g
24. According to the American Academy of Pediatrics, children under what age should never consume caffeine?
- 6 years
 - 12 years
 - 18 years
 - 21 years
25. What is the pH value range for Red Bull?
- 3.25-3.43
 - 4.2-6.2
 - 5.5-6.5
 - 7.0-7.2
26. According to a systematic review published in the Journal of the American Dental Association, what percentage of silver diamine fluoride was found to be an effective intervention for dental caries?
- 5%
 - 20%
 - 38%
 - 42%
27. Which of the following chemicals is not bioavailable after the product is rinsed away, and has high solubility and low substantivity?
- ACP
 - Casein phosphopeptide
 - Calcium sodium phosphosilicate
 - Arginine
28. Which of the following chemicals is defined as a sticky milk protein that stabilizes ACP by binding directly to enamel pellicle and plaque?
- ACP
 - Casein phosphopeptide
 - Calcium sodium phosphosilicate
 - Arginine
29. Which of the following chemicals contains calcium, phosphorous, sodium, and silica, and can buffer pH as well as deposit calcium and phosphate into demineralized areas to form new layers of hydroxyapatite crystals?
- ACP
 - Casein phosphopeptide
 - Calcium sodium phosphosilicate
 - Arginine
30. Which of the following is an amino acid naturally found in saliva and when placed in the oral cavity extrinsically can contribute to pH homeostasis through its metabolism and production of the byproduct ammonia?
- ACP
 - Casein phosphopeptide
 - Calcium sodium phosphosilicate
 - Arginine

The hidden truths behind the bottled water, sports drink, and energy drink market and the threat they pose to the oral cavity

NAME: _____ TITLE: _____ SPECIALTY: _____
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Educational Objectives

- Understand the caries process as it relates to extrinsic acid attacks
- Differentiate between bottled water, sports drinks, and energy drink contents
- Be familiar with the oral implications associated with beverage choices and provide interventions to promote remineralization and a homeostatic oral pH
- Be better equipped to educate patients on the risks of beverage choices as related to the dental caries process

Course Evaluation

- Were the individual course objectives met?
 Objective #1: Yes No Objective #3: Yes No
 Objective #2: Yes No Objective #4: Yes No

Please evaluate this course by responding to the following statements, using a scale of Excellent = 5 to Poor = 0.

- | | | | | | | |
|---|-------|----|---|---|---|---|
| 2. To what extent were the course objectives accomplished overall? | 5 | 4 | 3 | 2 | 1 | 0 |
| 3. Please rate your personal mastery of the course objectives. | 5 | 4 | 3 | 2 | 1 | 0 |
| 4. How would you rate the objectives and educational methods? | 5 | 4 | 3 | 2 | 1 | 0 |
| 5. How do you rate the author's grasp of the topic? | 5 | 4 | 3 | 2 | 1 | 0 |
| 6. Please rate the instructor's effectiveness. | 5 | 4 | 3 | 2 | 1 | 0 |
| 7. Was the overall administration of the course effective? | 5 | 4 | 3 | 2 | 1 | 0 |
| 8. Please rate the usefulness and clinical applicability of this course. | 5 | 4 | 3 | 2 | 1 | 0 |
| 9. Please rate the usefulness of the supplemental web bibliography. | 5 | 4 | 3 | 2 | 1 | 0 |
| 10. Do you feel that the references were adequate? | Yes | No | | | | |
| 11. Would you participate in a similar program on a different topic? | Yes | No | | | | |
| 12. If any of the continuing education questions were unclear or ambiguous, please list them. | _____ | | | | | |

- Was there any subject matter you found confusing? Please describe.

- How long did it take you to complete this course?

- What additional continuing dental education topics would you like to see?

Mail/fax completed answer sheet to:
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| 4. (A) (B) (C) (D) | 19. (A) (B) (C) (D) |
| 5. (A) (B) (C) (D) | 20. (A) (B) (C) (D) |
| 6. (A) (B) (C) (D) | 21. (A) (B) (C) (D) |
| 7. (A) (B) (C) (D) | 22. (A) (B) (C) (D) |
| 8. (A) (B) (C) (D) | 23. (A) (B) (C) (D) |
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| 13. (A) (B) (C) (D) | 28. (A) (B) (C) (D) |
| 14. (A) (B) (C) (D) | 29. (A) (B) (C) (D) |
| 15. (A) (B) (C) (D) | 30. (A) (B) (C) (D) |

AGD Code 150

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