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The taste of sugar: New ways to deal with sugar and sugar substitutes

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The taste of sugar: New ways to deal with sugar and sugar substitutes

EDUCATIONAL OBJECTIVES

1. Examine current science on fructose, polyols (natural sugar analogs), plant extracts, and their advantages and disadvantages
2. Categorize safe versus unsafe sweeteners
3. Discuss how different sugars act systemically as well as their effects on oral biofilm maturation

ABSTRACT

Humans have a drive for the taste of sweet which must be addressed by dentistry. Asking patients to avoid or fear sugar is not a workable solution. This course will take a look at plant-based sugars, identifying the problems with sucrose and fructose, and examining the qualities of exotics like yacon and monk fruit, as well as sweetener alternatives, like xylitol and erytritol.

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INTRODUCTION

Sweet is an innate taste preference handed down from antiquity that has been exploited, and our patients are paying the price. Avoiding sugar today is not simple. Organizing sugars in a hierarchy from damaging to medicinal may help dental professionals offer solutions that can not only promote dental health and stability, but also may improve overall health.

The taste of sweet was a signal to our hunter-gatherer ancestors that the food was safe to eat. Evidence in the animal kingdom for sweet preference is also under investigation, with findings that even pandas have a sweet tooth.[1]

Long-held beliefs about sugar (sucrose) have been undermined with the findings of Cristin E. Kearns, DDS.[2,3] Her remarkable findings, a cache of documents from the 1960s in a university library, shine a black light on sugar industry tactics. Those tactics mirror strategies used by the cigarette industry in winning over government and researchers to declare sugar as a harmless health food. Their deceitful plan has yet to be truly quantified in health-care costs.

There is much confusion surrounding sugar and sugar substitutes. There seems to be a unified disapproval of sucrose, especially in dental groups. The question of what to offer our patients instead is bewildering. The Internet is infested with "authorities" who steer people from one bad sugar substitute to another. Many dental professionals have no real idea what to say and may compromise their patients' health with their inexperience.

This confusion was very evident in a recent unscientific survey posted in various dental hygiene Facebook groups. When shown a photo of various sweetener packets and asked which contained erythritol, most of the nearly 100 respondents chose the option "none of the above." Erythritol is a bulk sweetener that is often mixed with intense sweeteners, such as stevia or monk fruit extract. People think they are choosing an extract of the stevia leaf when what they are really getting is a packet of erythritol with a fleck of the intense sweetener, stevia, included. The same is true when an intense sweetener such as sucralose is packaged with a disaccharide. To refresh the memory: examples of disaccharides are sucrose, lactose, and maltose.

The ideal is to offer our patients something that is not only dentally healthful, but systemically health promoting as well. Research continues on alternative sweeteners, focusing in on the good and the not-so-good.

FRUCTOSE—PLANT-BASED BULK SWEETENER

In current times, Dr. Robert Lustig, a pediatric endocrinologist, has been ringing the alarm bell about the dangers of sugar.[4] In his 2009 lecture, "Sugar: the bitter truth," available on YouTube, nearly eight million views inspired more than 10,000 people to leave comments.[5] Dr. Lustig has been leading a crusade against sucrose and its friendly cousin, fructose, for a decade. He explains how fructose, one-half of the sucrose molecule, leads to fatty liver in toddlers.

Natural-sounding sugars come with problems. Agave and honey are both natural sugars that are almost entirely fructose. Adding one or the other to a cup of tea is no better, likely worse, than adding a teaspoon of table sucrose.

Dr. Lustig delivered his final blow to sucrose by calling it the "alcohol of the child," referring mainly to the fructose side of this disaccharide. Fructose is so damaging because it is the primary sweetening agent in fruit, which is thought to be wholesome. High-density fructose from the juices of fruits or corn has found its way into nearly every food available to humans from infant formula to flavored corn chips. Our daily exposure to fructose is nearly immeasurable.

Food scientists strive to hit the perfect combination of salt, fat, and sweet, called the bliss point.[6] Food chemists have exploited Homo sapiens, highjacking their innate trust of sweet taste to give them more of what they crave. When consumers clamor for products, the industry will provide those new products as evidenced by fat-free, gluten-free, and sugar-free labels. The system becomes a perpetual-motion machine. Adding fructose to foods fuels the desire for more. Industry tries to make it affordable and shelf stable, and, although people don't die immediately, they suffer a slow, decades-long death. This extended death, as compared to infections, accidents, and infant mortality, feeds the medical behemoth.[7]

Most North Americans in the last 100 years or so were raised on the idea that fruit is good for people and that we should all eat fruit freely. Somehow, that was translated into fruit juices. Someone could drink the juice of an entire basket of oranges in one day, while their ancestors would likely have eaten only one or two oranges in one day, and only when oranges were in season. By drinking all that orange juice, the liver is overdosed fructose to metabolize

TABLE 1: ANALYSIS OF SWEETENERS

Intense sweeteners	Compared to sucrose
Stevia extract	200 times as sweet
Monk fruit	100–250 times as sweet
Sucralose (sugar invert)	600 times as sweet
Aspartame	200 times as sweet
Saccharine	200–700 times as sweet
Acesulfame potassium (Ace-K)	200 times as sweet
Neotame	7,000–13,000 times as sweet
Bulk sweeteners	
Xylitol	Equal to sucrose
Erythritol	40% as sweet
Sorbitol	50% as sweet
Non-nutritive sweeteners	

Nutritive sweeteners provide the body with calories, while non-nutritive sweeteners are very low in calories or contain no calories at all.

and stores it for later use as white adipose tissue. The industry gave us what we wanted, but we didn't know this was going to end up being deadly. Table 1 was developed from data taken from the U.S. Food and Drug Administration website.[8]

The focus on an ancestral diet—eating what one's ancestors ate—is good. The problem is that most people don't know their ancestry. Eating what one's grandparents ate is a good start, but in actuality nearly irrelevant. In the future, diets may be tied to DNA showing ancestral ties to geography.

What is an American Eskimo going to do with oranges? What if an Icelander has children with a person from India—what are their children metabolically able to handle? These are the next generation of questions that will need to be answered in light of factory farms and food-processing plants far from the location where the food is grown or consumed. The blood-type diet may be the closest to answering that question of an appropriate ancestral diet, since blood types are able to be mapped globally.[9]

High levels of ingested fructose are first stored as fat and then converted to uric acid. Evidence suggests that chronic hyperuricemia (excessive uric acid in the blood) is an independent risk factor for hypertension, metabolic syndrome, and cardiovascular disease. It is probably also an independent risk factor for chronic kidney disease, type 2 diabetes, and cognitive decline, such as Alzheimer's disease or type 3 diabetes.[10]

The following list of foods and food ingredients illustrates the diversity of products that contain fructose.[11]

- Agave syrup
- Caramel
- Fructose
- High-fructose corn syrup
- Honey
- Invert sugar
- Licorice
- Molasses
- Pancake syrup
- Palm sugar
- Sorghum

Sweetening with fructose must be done in small amounts.

DENTAL IMPLICATIONS OF FRUCTOSE

Both sucrose and fructose create similar pH drops in biofilms. In vitro studies show that the pH can drop to 5.[5] four hours after the challenge and continues to fall for 48 hours. Fructose is not a dentally safe alternative to sucrose.

SUCROSE—PLANT-BASED BULK SWEETENER

While fructose is a monosaccharide, sucrose is a disaccharide. Best known as sugar or table sugar, sucrose is comprised of one molecule each of glucose and fructose. The fructose half of the molecule is the most damaging. As a condiment added at the table, sucrose is not too harmful. However, sucrose is part of nearly every processed product intended for human consumption.

According to the University of California San Francisco (UCSF) website SugarScience, Americans consume nearly 57 pounds of sugar per year per person.[11] Sugar hides everywhere, even in places you would never expect it to be, such as in the coating on french fries. Hidden-in-plain-sight sucrose is masked behind deceptive terminology. Many health-care providers would recognize fruit juice concentrate as a sweetening agent, whereas muscovado and panocha are very cunning terms.[12]

Because of labeling deception, Americans and people around the globe consume more sucrose than they realize. The World Health Organization (WHO) has set global standards for consumption totaling 10% of total kilocalories (kcal) consumed. They further state that more health benefits can be realized by limiting free sugar to only 5% of total energy consumed. The WHO defines free sugars as all sugars added to foods or drinks by the manufacturer, cook, or consumer, as well as sugars naturally present in honey, syrups, fruit juices, and fruit juice concentrates.[13]

Sucrose offers a number of properties to foods that improve taste, mouth feel, and appearance. Dextrose, a form of sugar, is in the coating on french fries to help the fries turn brown, by a process called the Maillard reaction.[14] Not all sweeteners have this property, and this is why sugar is added to so many foods and and is why sugar is so difficult to avoid.

Several studies link sugar to cancer cell growth, although until recently, the method had been a mystery. In 2017, this sugar cancer mechanism was identified. Hyperactive sugar consumption by cancerous cells leads to a vicious cycle of continued stimulation of cancer development and growth. The researchers found how the Warburg effect, the effect of increased sugar breakdown by cancer cells, stimulates unbridled cell division and tumor growth.[15,16]

Studies continue to link sucrose to cardiovascular disease, diabetes, obesity, and, on a more positive note, pain reduction in neonates during normal painful procedures such as heel pricks.[17]

DENTAL IMPLICATIONS OF SUCROSE

Sucrose has long been on the dental list of problematic ingredients. Studies show that in the presence of sucrose, oral biofilms mature faster, express a lower pH, become denser, and affix more firmly to the enamel. The biofilms express more exopolysaccharides, protecting the mass from risks or threats when fed sucrose.

YACÓN—PLANT-BASED SWEETENER

Yacón is a dietary inulin-type oligosaccharide, or fructooligosaccharide, made from the root tubers of the yacón plant. Yacón sweetener is delivered mainly as a syrup and added as one would add sucrose to foods and drinks.

The sweetening component of this sucrose replacement is a fructooligosaccharide component of the tuber. While fructooligosaccharide sounds like fructose, it is considered a fiber and is listed in food labels as such.[18] It leaves the body undigested, meaning it has no calories. Recent reviews also provide support for fructooligosaccharide in lowering blood glucose[19] and minor decreases in serum cholesterol levels.[20]

DENTAL IMPLICATIONS OF YACÓN

While the fructooligosaccharides in the yacón plant may be good for you, the science on the dental benefits is not forthcoming. Hartemink et al. looked at this fructooligosaccharide and found it to be equal to sucrose in building oral biofilms.[21] This investigation took place in the mid-1990s. Look for more on this sweetener in the future.

STEVIA—PLANT EXTRACT INTENSE SWEETENER

What makes stevia seem so attractive is that people imagine it is a pure plant product. Manufacturers have taken advantage of the sweet reputation of this leaf by naming their products in a way that leads consumers to think they are getting pure stevia. Pure stevia is only available in the leaf form. Only the stevia extract is available for purchase in the US. The chemical compounds that produce its sweetness are the steviol glycosides—stevioside and rebaudioside—which offer a bitter aftertaste. The added bulk sugars try to mask the bitter aftertaste of some brands.

Many studies on the extracts of the stevia leaves have shown promise.[22–24] Caution is advised due to the difference in the study medium as compared to what is found on the consumer market.

DENTAL IMPLICATIONS OF STEVIA

Stevia does not promote oral biofilm and does not contribute to its mass.[25,26] There are few research papers on stevia with respect to periodontal disease. Considering the effect on biofilm growth and mass, it seems safe to say that stevia can be considered an agent against biofilm-based oral diseases.

MONK FRUIT—FRUIT EXTRACT INTENSE SWEETENER

Any word that includes the word fruit in it can't be bad, right? Suddenly seeing monk fruit sweetener on the shelves has people wondering what it is and how it came to be. The fruit itself was barred from transport out of its native Asian countries until recently. Like stevia, monk fruit sweetener is an extract. Unlike stevia, it is an extract of the fruit, not the leaves.

Monk fruit extract is about 200 times as sweet as sucrose. This means it is rarely sold to consumers as an extract alone. Monk fruit is often mixed with bulk sweeteners such as erythritol, disaccharides, or some packages boldly list dextrose.

One isolate of monk fruit, mogroside IVe, has shown promise in anticancer studies.[27,28]

DENTAL IMPLICATIONS OF MONK FRUIT

At this time, few studies are available on pubmed.gov concerning this sweetener. Until more studies become available, caution should be used when recommending monk fruit due to its being combined with potentially cariogenic bulk sweeteners.

XYLITOL—PLANT-BASED SUGAR ALCOHOL, BULK SWEETENER

Xylitol has equal the sweetening power of sucrose, looks like sucrose granules, and, since the early 2000s, has been easy to find in confections. Xylitol has a long and storied past and is one of the first sugar replacements that didn't come from the mind of a chemist. Plus, xylitol has proven to be an asset to the dental hygiene profession.

Xylitol sweetens foods and complements nearly all taste profiles. It does not express the Maillard reaction, meaning that xylitol in baked goods will require another ingredient to achieve the brown color. Xylitol also doesn't crystalize when heated, so additives are included in lollipops or clear candies touting this great sweetener. Another property of this versatile sweetener is that it is hygroscopic, attracting moisture to itself. Xylitol is an ingredient in some cosmetics because of this effect. This property is also a benefit when using this sugar alcohol in oral-care products.

Xylitol is made from plants that contain the polysaccharide xylan, a constituent of many pulpy plants. Using either natural yeast or a mild acid, such as malic acid, the cell walls are broken down to xylose, and then xylitol. Originally, xylitol was manufactured from birch tree bark. Today it is extracted from many different types of pulpy plants, mostly from the stalks, leaves, and cobs of the corn plant. The chemical makeup and the health benefits of the sweetener are identical regardless of its origin. Birch tree pulp is not as renewable as bagasse from annuals such as corn, sugarcane, or hemp.[29]

Because of xylitol's affinity to calcium, researchers have been intrigued with the possibility of using this versatile plant-based sweetener as a bone enhancer. Early studies showed promise with very high doses leading to increased bone volume and mineral content in the long bones of aged rats.[30] There may be some protection against age-related osteoporotic changes. On the other hand, sucrose has a measurable negative effect on bone, causing osteoporotic density shifts. Impairment in cortical bone morphology is most apparent in diets high in sucrose.[31]

Today, researchers are looking to xylitol as an ingredient in bone cement. Xylitol mixed with various antibiotics into bone cement have shown some improvement in the efficacy of the antibiotic.[32]

As the science of respiration becomes redefined to include dentistry by integrating the eustachian tubes, the palate size as indicative of the sinus size, as well as the tongue's interaction with the palate and pharynx, xylitol has been in the sights of researchers. Naso-diaphragmatic breathing is often hindered by reactions to allergens in the environment, forcing open-mouth breathing. Mouth breathing lowers oral pH into a dangerous zone.[33] Using a saline spray with xylitol has been shown to reduce nasal congestion and lower H. influenzae adhesion.[34]

Early childhood caries (ECC) is particularly heartbreaking, and xylitol has shown promise in this area as well. Stopping transmission of known cariogenic bacteria between parent and child is where xylitol shines. The connection between acute otitis media (AOS) and ECC[35] needs further exploration; however, xylitol nasal spray in children has been shown to reduce AOS onset and antibiotic days.[36] Dosing has yet to be determined.[37] Xylitol for airway health in the nose, ears, and mouth has yet to be fully realized. Stand by for xylitol research supporting arch expansion and reducing mouth breathing.

DENTAL IMPLICATIONS OF XYLITOL

Xylitol remains one of the best defenses against ECC, caries in general, periodontal disease, and upper airway infections. It reduces cariogenic bacteria, stunting maturation of oral biofilm, and protecting against caries and periodontal disease.

ERYTHRITOL—PLANT-BASED SUGAR ALCOHOL, BULK SWEETENER

Erythritol is taking the place of xylitol as the most misunderstood sweetener. While most of dentistry finally understands the role of xylitol for oral biofilm disease management, erythritol is coming up on xylitol's heels. Like xylitol, erythritol is a sweetener

with medicinal properties. Erythritol is used as a bulking agent that mixes well with intense sweeteners because it is about half as sweet as sucrose.

Erythritol comes from plant material as a four-carbon sugar compared to the five-carbon configuration of xylitol—fructose 6 carbons and sucrose 12 carbons. The body and intestinal bacteria cannot use it as an energy source, making it totally calorie free.

Erythritol provides health-promoting benefits for both diabetes and cardiovascular health.[38-40]

Erythritol affects cariogenic and periodontal pathogens in direct contact. When used as a medium for subgingival air polishing, treatment time is reduced and outcomes are improved.[41] In caries studies on children, reduction in caries and time to caries development proved erythritol to be better than xylitol.[42] One of the important aspects of this sugar alcohol is its effect on Streptococcus mutans (S. mutans) and Porphyromonas gingivalis (P. gingivalis). In vitro studies are promising. Using erythritol as a topical agent multiple times a day in a candy or gum can produce healthier oral biofilms.[43]

The ketogenic diet (high fat, moderate protein, carbohydrate below 30 grams per day) favors this sugar—not because of its reduction in calories or sweetness, and not because of the slower gastric emptying, but because erythritol has zero net carbohydrates. Use of this sweetener requires no insulin output.[44] It is one of the few natural sweeteners that is considered to be nonglycemic.[45]

Research continues into possible additional benefits as erythritol is being tested as a novel, environmentally sustainable, and human-safe approach for insect pest control. As fruit flies ingest this human-safe sweetener, the results imply that erythritol is transported from the fruit fly midgut without being metabolized and stored; instead, it is accumulated in the system. Like the early bacterial biofilm colonizers, the fruit fly starves to death.[46]

DENTAL IMPLICATIONS OF ERYTHRITOL

Erythritol shines in many aspects of health promotion. In dentistry, using erythritol topically and recommending its use systemically can be a game changer for patients with what is commonly called sugar addiction. Erythritol has a dramatic effect on in vitro biofilm. It has been shown to reduce caries in vivo and has application as a professional topical agent. As a replacement for sucrose, a recommendation for products containing erythritol is sure to make the transition a healthy one.

CONCLUSION

There are many natural sweeteners to replace the ones people are using today. As dental health providers, we must stay abreast of the constant barrage of new products and how they impact the oral environment. By standing firm against sucrose without recognizing the ancestral drive for sweetness—and even more the insidious drive exploited by food producers—we are not offering the best possible service. Too many dental offices have posters of a pyramid of sugar cubes next to an array of soft drink cans educating their patients about the amount of hidden sugar, without offering them safe alternatives.

The "read the label" mantra is still a good one. Instead of learning the 60 names for hidden sugars on the label, teaching our patients and clients to look for xylitol, erythritol, or stevia (knowing that it is mostly erythritol) could get our patients back to health from the inside out. Our patients are counting on our professional curiosity—the kind of curiosity that takes into consideration our education and clinical experience—to formulate provocative questions and find the answers. Professional curiosity requires one to be open to unexpected information that doesn't support initial assumptions. Dr. Cristin Kearns's professional curiosity led her to discover the sugar industry documents. Her curiosity is a great model for all of us. Let's be advocates for our patients by showing them alternatives that are systemically and dentally healthful.

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SHIRLEY GUTKOWSKI, BSDH, RDH, is a career dental hygienist and champion of minimally invasive dental hygiene. She is the recipient of the World Congress of Minimally Invasive Dentistry Leadership Award, a popular author, international speaker, and radio host on Cross Link Radio. In 2016, she started a new adventure: Primal Air, LLC OMT and Breathing Retraining is her practice in her hometown. She sees clients in person as well as uses telemedicine platforms, trains offices in what to look for by focusing on the airway, and continues her writing and speaking career with these new topics using her love of minimal intervention and early diagnosis in a whole new way.

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QUESTIONS

1. **The World Health Organization (WHO) recommends that adults worldwide curb free sugar in their diets to be what percentage of total kcal consumed?**
   A. Less than 10%
   B. Less than 5%
   C. They tolerate no added sugar
   D. None of the above

2. **To improve health further, the WHO recommends that adults limit free sugar to less than:**
   A. 5%
   B. 10%
   C. 1%
   D. The WHO has no reference for sugar consumption

3. **Dr. Kearns's professional curiosity led her to discover:**
   A. Why a lecturer mentioned that sugar was not problematic
   B. How sucrose was good for humans
   C. How to use a university library
   D. How the sugar industry cloaked science to hide the dangers of sugar

4. **Professional curiosity is defined as:**
   A. Being open to unexpected information that doesn't support initial assumptions to assessments
   B. Taking into consideration our education and clinical experience to formulate provocative questions and find answers
   C. Both A and B
   D. None of the above

5. **How are intense sweeteners delivered to consumers?**
   A. Mixed with bulk sweeteners
   B. In flecks
   C. As a liquid
   D. As stevia

6. **Which of the following sweetener pairs come from plants?**
   A. Xylitol, erythritol
   B. Yacón, agave
   C. Monk fruit, stevia
   D. All of the above

7. **Which of the following sweetener pairs have positive cardiovascular effects?**
   A. Honey, agave
   B. Monk fruit extract, stevia extract
   C. Xylitol, erythritol
   D. Yacón, fructose

8. **What does it mean to have zero net carbs?**
   A. Releases no insulin
   B. Carbs from vegetables and fruits combined
   C. Improves gastric emptying
   D. Travels through the hepatic portal

9. **How are sweeteners categorized?**
   A. Intense and bulk
   B. Insulin-releasing and non-insulin-releasing
   C. Plant-based and lab-based
   D. Good and bad

10. **Fructose is indicated as a common factor in:**
    A. Type 3 diabetes, Alzheimer's disease, cognitive decline
    B. Hypertension, metabolic syndrome
    C. Type 2 diabetes, cardiovascular disease
    D. All of the above

11. **Blood typing may be a good indicator for:**
    A. Establishing continental divides
    B. Illustrating the effects of fructose
    C. Establishing an appropriate ancestral diet
    D. How Weston A. Price evaluated diets

12. **The Maillard reaction is desirable because it:**
    A. Enhances sweetness
    B. Enhances color in heated foods
    C. Makes baked foods tolerable
    D. Makes french fries healthier

13. **Stevia leaves have been shown to:**
    A. Require many processing steps to be palatable
    B. Stop sugar cravings
    C. Have a bitter aftertaste
    D. Act as a bulk sweetener in sweetener packets

14. **Steviol glycosides are useful for:**
    A. Antifreeze
    B. Boiling water
    C. Sweetening hot drinks
    D. Dissuading termites

15. **Fructose can be found in:**
    A. Palm sugar
    B. Molasses
    C. Honey
    D. All of the above

16. **Fructose maintains biofilm pH:**
    A. Better than sucrose
    B. The same as sucrose
    C. The same as yacón
    D. Better than monk fruit

17. **Sucrose is what kind of molecule?**
    A. Monosaccharide
    B. Disaccharide
    C. Nano saccharide
    D. Saccharine

18. **Why are french fries sometimes coated with sucrose?**
    A. To improve the bliss point
    B. To manufacture heat
    C. To aid in browning
    D. To decrease calories

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QUESTIONS

19. Which is one of the few benefits of sucrose?
- A. Makes teeth whiter
- B. Stops obesity
- C. Pain reduction in neonates
- D. Distracts children from unwanted habits

20. Fructooligosaccharides are found in:
- A. Yacón tubers
- B. Stevia leaves
- C. Corn stalks
- D. Bagasse

21. Fructooligosaccharides:
- A. Affect the biofilm by disrupting early colonizers
- B. Are equal to sucrose in building oral biofilms
- C. Lower biofilm pH by a factor of five
- D. Are inert as a biofilm modifier

22. Stevia leaves:
- A. Harbor extracts that taste bitter
- B. Contain chemical compounds that taste sweet
- C. Are commercially available for use
- D. Both A and B

23. Stevia is an intense sweetener that:
- A. Is about as sweet as sucrose
- B. Is about 200 times sweeter than erythritol
- C. Is great at fighting periodontal disease
- D. Doesn't promote oral biofilm

24. Monk fruit:
- A. Is an intense sweetener
- B. Has few studies on periodontal disease effect
- C. May be mixed with cariogenic bulk sweeteners
- D. All of the above

25. Xylitol is manufactured from:
- A. Birch bark or leaves
- B. Corn leaves or kernels
- C. Birch wood and pulpy plants, such as hemp or corn stalks
- D. Stevia leaves

26. Medicinally, xylitol can be used for:
- A. Caries management
- B. Bone enhancement
- C. Improvement in antibiotic efficacy
- D. All of the above

27. Naso-diaphragmatic breathing:
- A. Is easier with xylitol in the sinuses
- B. Can help fight ECC
- C. Causes respiratory infections
- D. Is a problem for people with braces

28. Erythritol is categorized as:
- A. A plant-based sweetener
- B. An intense sweetener
- C. Both A and B
- D. An insecticide

29. Erythritol reduces dental hygiene treatment time when:
- A. Used as a prerinse
- B. Incorporated into scaler blades
- C. Mixed with scaler lavage
- D. Used for subgingival air polishing

30. What is the best way to teach our patients about sugar?
- A. Illustrate sugar content in foods and drinks
- B. Lecture about sugar during hygiene appointments
- C. Teach patients professional curiosity
- D. Teach patients safe sugars to look for on labels

NOTES

PUBLICATION DATE:	JULY 2019
EXPIRATION DATE:	JUNE 2022

ANSWER SHEET

The taste of sugar: New ways to deal with sugar and sugar substitutes

Name: Title: Specialty:

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EDUCATIONAL OBJECTIVES

1. Examine current science on fructose, polyols (natural sugar analogs), plant extracts, and their advantages and disadvantages
2. Categorize safe versus unsafe sweeteners
3. Discuss how different sugars act systemically as well as their effects on oral biofilm maturation

COURSE EVALUATION

1. Were the individual course objectives met?

Objective #1: Yes No Objective #2: Yes No

Objective #3: 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
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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.

_____

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

_____

14. How long did it take you to complete this course?

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4.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	19.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
5.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	20.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
6.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	21.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
7.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	22.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
8.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	23.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
9.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	24.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
10.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	25.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
11.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	26.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
12.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	27.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
13.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	28.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
14.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	29.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
15.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	30.	Ⓐ	Ⓑ	Ⓒ	Ⓓ

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