



## EDITORIAL

DOI: 10.17126/joralres.2016.011

Dental caries continues to be the most prevalent human condition<sup>1</sup>. Although countless efforts have been made to decrease the high prevalence of the disease, data worldwide clearly show that little improvement has been achieved. The latter is a reality that the dental profession must face and take immediate action. If important resources have been dedicated and many professionals are struggling with caries day by day, why have we not been capable to decrease the high prevalence of the disease? If researchers, policymakers and clinicians do not understand current caries pathogenesis, it is very difficult to design strategies that are pertinent and efficient.

Conceptual definition of dental caries has changed over the past few years. To the classic conception of a triad of factors acting with the same intensity to induce caries; microorganisms, a susceptible tooth and a fermentable substrate, other factors have been added. These other factors include salivary flow, fluoride exposure, frequency of sugar consumption, quantity of plaque, among several others. From a microbiological point of view, caries was thought for many years as an infectious and transmittable disease caused specifically by the pathogen *Streptococcus mutans*. These concepts are outdated and must be replaced by modern views on the problem. **Currently, dental caries may be considered as an ecological sugar-dependent dysbiosis caused by pathobionts<sup>2</sup>.**

Under a balanced and healthy diet, low in sugar, the commensal and highly abundant streptococci are capable to metabolize carbohydrates and produce acids. Although these acids can initiate demineralization, physiological mechanisms in the mouth, *i.e.*, saliva, can restore pH, halt the onset of the lesions and remineralize the tissues at the crystal level, before cavitation. When sugar is consumed at a high frequency from the diet, however, an ecological imbalance of the microbiota of the mouth is created<sup>3</sup>. This imbalance is called dysbiosis, whereby ubiquitous microorganisms of the

## Sugar and dental caries: new insights of an old problem and its implication in clinical management.

dental biofilm become more virulent by bacterial competition. Some of the acidogenic species that are better endowed to survive under acidic conditions tend to prevail over their competitors, leading to a pH drop, which in turn favors demineralization of enamel and dentin<sup>4</sup>.

Bacteria that act as commensal under healthy conditions, but turn pathogenic when the ecological balance is broken, are called pathobionts. The steady exposure of sugars to the biofilm causes disruption of the microbial balance in the oral environment. Thus, sugars must be considered as the main, and probably the only, etiological factor of caries<sup>5</sup>. Sugar is a rather wide term to refer to carbohydrates. Despite the possibility that most of the dietary carbohydrates are metabolized by the oral bacteria, simple sugars, either mono or disaccharides, are far more dangerous in terms of caries. Special attention must be paid to sucrose, a disaccharide composed by glucose and fructose. Sucrose is considered to be the most cariogenic sugar. Many bacterial species of the dental biofilm can efficiently use the molecule as a rapid source of energy, but also sucrose is very efficiently used as substrate for the production of polysaccharides, which constitute a defensive gel-like structure of the dental biofilm.

In the daily practice and in most of the commercially-driven messages to the people, strong emphasis has been devoted to oral hygiene and to the use of fluoridated products in their many commercial presentations. It is not my intention in this letter to state that correct toothbrushing and flossing are not necessary or to dismiss the crucial role of fluoride in caries prevention. Yet, caries is a process mainly due to frequent sugar consumption. Since bacteria will be always present on enamel and root dentin, the most important factor to deal with is sugar, particularly sucrose. As a sugar-dependent entity, preventive strategies cannot be focused on oral hygiene. Even in the absence of a correct hygiene, caries would be kept at a very low rate if sugar consumption were low and infrequent, just like it was in ancient humans, befo-



re the industrial revolution.

Preventive efforts, therefore, should not deplete all the usually scarce resources on the use of fluoridated products, such as varnish. It may be true that a single application of fluoridated varnish can reduce caries for a rather long period of time. The question is; what is it going to happen after the release of all the fluoride ions from the reservoirs, in a person that is frequently consuming sucrose from the diet? The most likely scenario is that the ecological imbalance will continue to exert its damage to the tissue and without the protection interference from fluoride, the process will progress at a more accelerated rate. The reader may agree with me in that messages to the people from the media (radio, TV, newspapers or social media) are addressed to increase the use of toothbrushes with almost “magic” properties or some mouthwashes that can kill all the bacteria in the mouth. The advice to reduce sugar consumption is almost non-existent. Unfortunately, many dentists follow the same trend, concentrating their strategies on achieving better biofilm control or on applying some therapy, such as sealants or fluoride to cope with a high-risk patient.

Even if the role of sugar in caries were better understood by the dental profession and the public, a change in the pattern of consumption would be hard to attain. Most of the processed foods available in the market are loaded with variable amounts of sucrose. It has been very difficult to decrease the amount of sugar contained in carbonated beverages, cakes, cookies, yogurts, milk and basically, any food in a package. Weak progress is being achieved in some countries, included Chile, with novel initiatives of labeling food packages to warn the public on the high content of

sugar and the health consequences. Mexico was the first country in applying a tax for sugar. In 2014, the authorities introduced a 10 per cent tax on sugar-containing beverages. The reason why Mexico took this measure was because they had become the most obese country in the world.

Instead of trying to do advocacy for a governmental support to reduce caries, the dental profession should deal with caries in a multidisciplinary approach. The world is experiencing an obesity and diabetes pandemic, with alarming and increasingly higher rates. Since the most relevant factor in both conditions is sugar consumption, as well as it is in caries, multidisciplinary and aligned efforts must be steered. It is very difficult to think that people will change or modify sugar consumption because of caries.

If the efforts are triggered to cope with diabetes, obesity and caries, however, it is reasonable to expect better results and a more efficient use of the human, technical and monetary resources. At an individual level, dentists should spend more time explaining to their patients the importance of controlling sucrose consumption, not only in the context of caries control, but also with a systemic health view. Furthermore, the dentist and the dental profession as a whole must be engaged in the interdisciplinary work of the healthcare providers. Caries reduction is possible, but it mandates to trigger its main causative factor; sugar.

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## REFERENCES.

1. Kassebaum NJ, Bernabé E, Dahiya M, Bhandari B, Murray CJ, Marcenes W. Global burden of untreated caries: a systematic review and metaregression. *J Dent Res.* 2015;94(5):650–8.
2. Simón-Soro A, Mira A. Solving the etiology of dental caries. *Trends Microbiol.* 2015;23(2):76–82.
3. Díaz-Garrido N, Lozano C, Giacaman R. Frequency of sucrose exposure on the cariogenicity of a biofilm-caries model. *Eur J Oral Sci.* 2016;In press.
4. Fejerskov O. Changing paradigms in concepts on dental caries: consequences for oral health care. *Caries Res.* 2004;38(3):182–91.
5. Sheiham A, James WP. Diet and Dental Caries: The Pivotal Role of Free Sugars Re-emphasized. *J Dent Res.* 2015;94(10):1341–7.