

Sugar reduction in confectionery and related applications

Abstract

The World Health Organization (WHO) recognizes obesity as a global epidemic of public health concerns. Diet has a role on the incidence of obesity, consequently the WHO suggests among other strategies, to reduce the caloric intake arising from free sugars to below 10% of the total daily caloric intake. Sugar-reduction is therefore of interest to the food industry, in particular to markets that are traditionally based on the use of sugar, such as confectionery and market segments that use confectionery technology. Sugar alcohols provide solutions in terms of sweetness, functionality, and bulk at reduced calories, while fibers can provide additional nutraceutical solutions for further claims.

Keywords: confectionery, fibers, obesity, polyols, sugar alcohols, sugar reduction, nutraceuticals

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Introduction

The obesity epidemic is a global public health concern; in the US obesity has been associated with leading causes of preventable deaths, such as cardiovascular disease, stroke, and diabetes.¹ The WHO suggests that diet and physical activity are key parameters to achieve a healthy body weight, and therefore has granted dietary recommendations. These recommendations include limiting the intake of fats and reducing the consumption of free sugars (monosaccharides and disaccharides) to no more than 10% of total daily calories.² Free sugars are found in many shelf-stable foods (cereals, snacks, sauces, dressings, and others), therefore sugar reduction is a current topic of interest to the food industry. Confectionery in particular, is a market that is traditionally based on the use of sugar (sucrose). Although, sugar confectionery as well as sugar-free confectionery have their established place within healthy eating patterns (in moderation), there is additional interest in sugar reduction in confectionery and related applications.

Sugar and sugar-free confectionery

Sugars are carbohydrates with a variety of properties, such as chemical structure, glass transition temperature, sweetness, solubility, refractive index, and others.³ From a food label perspective, sugars are defined as the total amount of monosaccharides and disaccharides present in the food product. Examples of monosaccharides are glucose (dextrose) and fructose. Sucrose (table sugar) is an example of a disaccharide sugar comprised by glucose and fructose. Traditional, sugar-based confectionery, makes use of both monosaccharides and disaccharides. Honey, invert-sugar, high-fructose corn syrups and some glucose syrups (depending on their dextrose equivalency) are classified as sugars or mostly sugars. Sucrose-based confectionery is based on a combination of sucrose and glucose syrup, with the specific ratio between these two ingredients impacting the overall texture of the final product (e.g. fudge (more crystallized, higher sucrose content), taffy candy (less crystallized, more glucose syrup content than fudge)).⁴

For sugar-free confectionery, the building blocks are sugar alcohols (also known as polyols). Sugar alcohols are most commonly

commercially derived from the hydrogenation of monosaccharide or disaccharide sugars. Most polyols have approximately half the calories of sucrose, sweetness ranging from ~66-90% that of sucrose, and offer glycemic impact control which is crucial when formulating for diabetic individuals. There are various types of sugar alcohols, with maltitol, sorbitol, and xylitol being quite common in commercially available sugar-free candy. Many crystalline sugar alcohols have an appreciable negative heat of dissolution which causes a "cooling" effect in the finished product. However, the cooling effect varies from sugar alcohol to sugar alcohol and its perception depends on the application. For example, sorbitol and xylitol are common ingredients in sugar-free chewing gum and mints, where their cooling effect is highly valued for breathe freshening.⁵ Maltitol has a minor cooling effect and its impact may not be noticeable in grained applications. Maltitol is the polyol that most closely resembles sucrose in sweetness and solubility. Therefore, maltitol can be used as a full sucrose replacement in many confections without the need for high-intensity sweeteners.

Sugar reduction in confectionery and related markets

In the US, sugar reduction refers to at least a 25% sugar (monosaccharide and/ or disaccharide) reduction when compared to a control reference.⁶ Sugar reduction in confectionery applications may arise from the partial replacement of crystalline sucrose and/ or glucose syrup. The food scientist would be best to determine the substitution to maintain processing conditions, functionality, flavor, and product shelf life. Notice that sugars cannot be replaced by high-intensity sweeteners, since these are commonly used at concentrations below that of 0.5 % and do not provide bulk. Therefore, sugar replacement needs to be accomplished by utilizing ingredients with bulking power. Sugar alcohols do provide bulking power while providing sweetness, and depending on the application they can be used as a direct substitute for sucrose and/ or glucose syrup. For example, sugar reduced gummies can be formulated with reduced sucrose (partially replaced by maltitol) and glucose syrup (partially replaced by high-maltitol maltitol syrup). Similarly, reduced sugar caramel can be made by partial replacement of sucrose by maltitol, and reduced-sugar compound coating can also be made by replacing crystalline sucrose by maltitol crystal.

While traditional candy remains a strong market, additional applications that utilize confectionery technology emerged (e.g. the snacks and nutraceutical markets). It is now common to see at the supermarket products that result from a hybridization of both traditional confections and snacks (e.g. cereal chocolate clusters, chocolate covered protein bar bites, etc.). Furthermore, purely nutraceutical products such as gummy bears to deliver vitamins and/or fiber, or candy chews to deliver fiber and/or vitamins are also common. These market segments, in addition to sugar reduction, are also interested in market trends such as protein addition and/or fiber fortification. Therefore, sugar reduction in confectionery items intended for these purposes can be achieved by not only utilizing sugar alcohols for sugar reduction, but by utilizing ingredients that provide additional value added, such as fiber and protein. Although fiber and protein are not substitutes for sucrose or sugar alcohols, they can be incorporated in selected items for an overall sugar reduction and health benefit claim.

For example, reduced sugars confectionery coatings can be used to formulate for reduced sugars snacks. A partial substitution of sucrose by fiber or protein can lead to a coating that is not only reduced in sugars but is fiber or protein enriched, respectively. Soy, whey and pea proteins can be used for partial sucrose replacement in coatings. Pea protein, which is sourced from yellow peas, is not a major allergen and allows to produce confectionery coatings that are also vegan. The resulting reduced-sugar, protein-enriched coatings can then be used for the formulation of reduced-sugars healthful snacks, such as breakfast bars with protein or protein-enriched products for sports nutrition. Another way to achieve sugar reduction in nutraceutical products is that of using fiber for partial sucrose replacement. However, not all fibers (soluble fibers as it applies to this article) are the same. Fibers can have various sources and can be processed in different ways, leading to various degrees of monosaccharides and disaccharides in the overall composition. Some soluble corn fiber have low or negligible amounts of monosaccharides and disaccharides, and these are ideal for sugar-reduction applications. Gummies, which are a common vehicle for the delivery of vitamins, minerals, and other nutraceutical components, can easily be reduced in sugar by incorporating soluble

fiber in their formulation. Soluble corn fibers are usually within the range of viscosity that allows for the gummies to be produced without changing processing conditions.

Conclusion

Sugar reduction is a topic of current interest to the food industry. Much of the technology used for sugar-free and reduced-sugars confectionery is also used in snacks and nutraceutical applications. Therefore, sugar alcohols and soluble fibers are ingredients that provide sugar reduction solutions for confectionery and related applications.

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None.

Conflict of interest

Roulette Americas Inc. is an ingredients company that among others produces sugar alcohols and soluble fiber.

References

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