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Using design thinking to increase sugar reduction options in consumer food products

Part 1, Sugars and the design thinking framework

KEYWORDS: Sugar reduction, design thinking, sweeteners.

ABSTRACT

Sugars are integral to most food products, providing or enhancing taste, texture, and stability. Because of health concerns, consumers want products with less sugar but that still have great taste. Many sugar substitutes are available, but every product system has unique characteristics and trade-offs, and this can create uncertainty for the product developer. Design thinking approaches give product developers a way to consider how best to reduce sugar. This article, Part 1 of a 2-part series, discusses sugars and their role in foods. The design thinking framework of desirability, feasibility, and viability is introduced along with practical examples. A separate article, Part 2, will explore how the framework can be applied across a wide range of product examples.

Product developers have numerous options to reduce sugar in products – maybe too many – which makes it hard to know where to start. Design thinking helps give product developers an edge by enabling them to look at their products differently, with more empathy for the consumer and a better understanding of sugar's role. With the design thinking approach product developers can pursue a better and more focused formulation path, delighting the consumer with the products they desire.

INTRODUCTION

Sugar. Azucar. Sucre. Zucchero. Zucker. In any language and culture, sugar is an important ingredient in many foods, creating the flavours and textures that consumers demand. However, sugar in excessive amounts is also a health concern (1). This dichotomy leaves food companies with the dilemma of creating food products that consumers enjoy and want to purchase while respecting the goal of improved health. With so many different products, and so many ingredient options that provide sweetness, how can product developers deliver more innovation to meet consumer wants, health objectives and business needs? Design thinking may be the answer to faster, and more focused product development. This article, Part 1 of a two-part series, suggests that new options for reducing sugar begin with understanding sugar and its role in food, while also understanding design thinking and how to apply it to product development.

Sugar cubes

AN OVERVIEW OF SUGAR

Sugar, the simplest of all carbohydrates, is a member of the saccharide family. Although more complex carbohydrates such as polysaccharides or oligosaccharides also have a characteristically sweet taste, sugar generally refers to monosaccharides or disaccharides including glucose, fructose, galactose, lactose and sucrose and maltose (2). Monosaccharides consist of a single sugar molecule while disaccharides are composed of two monosaccharides linked together (3):

Monosaccharides	Disaccharides
• Fructose • Galactose • Glucose	• Sucrose (table sugar) = glucose + fructose • Lactose (milk sugar) = glucose + galactose • Maltose (malt sugar) = glucose + glucose

In foods, sugars can be naturally occurring (such as in dairy products, fruits, and vegetables) or added (such as in desserts, sweetened beverages, cereals, and candies). Added sugars can include monosaccharides, disaccharides, or artificial sweeteners. Artificial sweeteners are either natural products, naturally derived, or synthetic. Many artificial sweeteners are non-nutritive or high intensity that impart sweetness with little to no caloric value (4,5,6).

Natural product or naturally derived	Synthetic or processed sweeteners
• Agave Nectar • Honey • Stevia Leaf Extract • Corn Syrup • Luo Han Guo or monk fruit	• Acesulfame potassium • Aspartame • High-fructose corn syrup • Neotame • Advantame • Saccharin • Sucralose • Sugar Alcohols

Despite popular perception, sugar adds more than just a sweet taste. It is a key ingredient that impacts the function and form of many foods:

Application	Examples of purpose
Flavour enhancement and balance	Helps to enhance flavours by increasing the aroma of the flavour. Used to balance sweetness and acidity
Shelf life	In beer, helps to determine shelf life, and improves the palate fullness and oxidative stability (7).
Food safety, water activity	Sugar's hygroscopic nature is critical in reducing water activity in foods. This helps to maintain food safety, preventing food spoilage, and ensuring quality (8).
Baking	Interacts with proteins/starches, speeds the growth of yeast, inhibits flour gluten formation, and delays starch gelatinization.
Fermentation	Serves as a food source in fermentation reactions which are critical to breads and increase the shelf-life and flavour of dairy products
Bulking, texture	Provides bulk which imparts mouthfeel and texture in many products; acts as a carrier for other ingredients and a tenderiser in bakery products via water absorption.
Browning, foams, and creams	Caramelises under heat, incorporates air in creaming, stabilises beaten egg foams, responsible for the Maillard reaction
Canning, jellies, preserves	Regulates gelling, prevents spoilage, improves fruit appearance
Candies and crystallisation	Enables numerous candy formats through recrystallisation
Frozen foods	Delays discoloration of frozen fruits and enhances smoothness/flavour of ice cream.

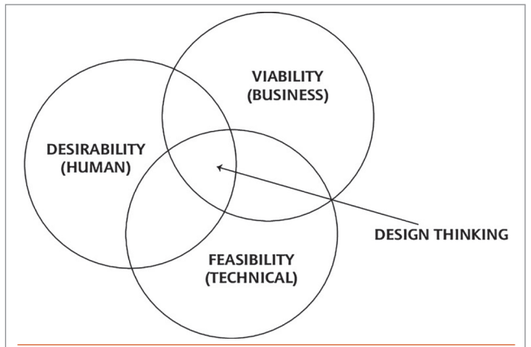
Reference number (9,10,11)

Examples of Sugar Reduction Approaches

With sugar playing a varied and critical role in so many food systems, reducing sugar levels can be challenging. Newer technologies to address the complicated path of sugar reduction include ingredients that either replace the sweetness and functionality of sugar, or block the bitterness often associated with artificial sweeteners.

The UK flavour house Synergy has a dairy-based natural flavour that can help reduce 30% of the sugar in cookies or biscuits (12). The flavour helps create the sweetness while the dairy-based ingredients mimic the mouthfeel and texture of sugar. MycoTechnology of Aurora, Colorado, USA produces a bitter blocker made from fermented mushrooms that purportedly blocks all 25 different kinds of bitter receptors, leading to a 50-90% reduction in added sugar (13).

Sugar reduction in gelato has long been considered extremely challenging as sugar is needed for flavour, and is also critical to gelato's velvety texture and mouthfeel. Part of achieving this texture is creating the right ratio of solids to water, typically 32 to 46%. Recently, Carpigiano unveiled a machine that produces gelato with either no added sugar or low-sugar using an Italian artificial sweetener called Diete. Tic. The machine uses computer algorithms and temperature-controlled gas to control the solids to water ratios (14).



Source: IDEO

AN OVERVIEW OF DESIGN THINKING

The role and type of sugar impacts food products, and approaches to formulating or re-formulating products to reduce sugar vary greatly. One such approach to product development is design thinking (15). The design firm IDEO is often credited with popularising design thinking and the Desirability-Feasibility-Viability framework (DFV) which is applicable to food product development. Using design thinking, a developer can find success where desirability, feasibility, and viability intersect. While most product development considers consumer preferences, production capability, sales channels and costs, the DFV framework looks at these factors a bit differently.

	Typical Product Development Approach	Design Thinking DFV
Desirability	Do consumers like the prototype?	What do consumers need? What value is this product providing? What consumer problem does it solve?
Feasibility	Can we make it? What equipment would we need?	How might this be produced? What process could be used? Who can partner with us to create the product?
Viability	Does the new or reformulated product fit the cost requirements of the product line?	What is the value to the consumer? What features will the consumer look for this product? What benefit are we providing compared to the competition?

Design thinking focusses first on empathy for the consumer, while traditional product development often moves quickly to determine if the consumer likes what the current production facility can produce. This is a subtle yet powerful difference. Empathy for the consumer does not mean that other factors are not important or should not be considered. Rather, all aspects of the product – from the formula to the process, package and distribution – must be considered equally to find the best solutions.

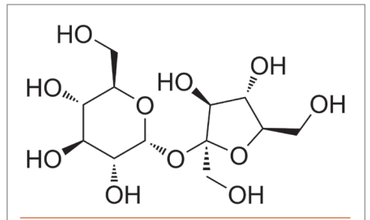
Applying the DFV Framework to Sugar Reduction

How does design thinking and the DFV framework impact sugar reduction? Whether formulating a product to be low in sugar or re-formulating a product to reduce sugar, the first step is to consider the importance of sugar's role in the product by utilising the DFV framework.

	Identify sugar's role
Desirability	Sugar and sweeteners meet the consumer need for flavour, or for desired product characteristics like texture.
Feasibility	Sugar is needed for product stability and food safety, e.g. impacting water activity
Viability	Sugar drives the economic value of the product, e.g. provides bulk as a low-cost ingredient, or provides shelf-stability which allows for certain sales channels.

Understanding sugar's role creates a faster, more focussed path for its reduction or replacement. For example, if sugar's primary role is related to desirability and the overall product flavour, but not to the product's stability or food safety, then a reduction strategy should focus on delivering a similar taste and flavour profile. A combination of reducing sugar levels and adding substitutes should provide sweetness with limited changes to the product's overall flavour impact. The flavour impact may be related to overall sweetness as well as the time-intensity of sweetness and other basic tastes.

Is the product perceived as sour first, and then sweet? That order of perception may be part of consumer expectations. Sugar reduction strategies that increase bitterness or alter sourness perception may not deliver on the consumer's expectation, while slight increases in saltiness may enhance the overall flavour even with reduced sugar levels.



Sucrose

If sugar is driving food safety – the feasibility of the product – then reduction strategies would focus on changes that would create a safe product. Changes in processing, along with altering ingredient levels while still maintaining the desired water activity and pH, may provide the keys to a successful reformulation.

Product viability may be based on sugar's low cost. Particularly for lower priced products with high pricing sensitivity, sugar reduction strategies may need to focus on replacing sugar with other low-cost ingredients. However, formulation changes may not be necessary. To maintain a market price point, perhaps a smaller size or lower weight package would meet the market need, requiring minimal formulation changes but still lowering the sugar per serving. More examples of these strategies will be included in Part 2 of this article.

SUMMARY

Consumers enjoy what sugar brings to foods but are concerned with excess sugar consumption. Food companies need new approaches to meet these conflicting consumer desires, such as the design thinking approach presented here. Considering the role of sugar in each product formulation and how it impacts desirability, feasibility and viability, can shorten product development timelines and improve outcomes. The upcoming article, Part 2, will illustrate how the DFV framework can guide successful sugar reduction strategies through a wide range of product examples.

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