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How do Adults Consume a Safe Level of Free Sugar?

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Abstract

Overweight, obesity, type 2 diabetes and associated chronic health conditions continue to be a global public health concern and we continue to search for the cause in our changing diet and lifestyle. In recent years, sugar has been demonised as the root of all health problems and particularly free sugar which is the sugar that is added to foods and drinks. But is there a safe level of free sugar to consume in the adult diet? Does sugar deserve its new demon status? And how do we improve our sugar intake?

Keywords: Vegetables; Food manufacturers; Milk products

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Introduction

The debate about sugar is not new. In 1972, John Yudkin first described the hidden dangers of sugar in his book Pure, White and Deadly [1]. He believed that increasing levels of coronary heart disease and other non-communicable diseases were being caused by excessive sugar consumption. However, the prevailing belief at the time was that a low fat diet may be better placed to prevent heart disease and this became ideology despite the mean population BMI continuing to increase [2]. As we strived to make the low-fat diet accessible, food manufacturers were replacing fat in these low-fat products with sugar [3]. So who was the demon – fat or sugar?

This review aims to define free sugars and how we measure safety in health, provide an overview of international guidelines on sugar intake and current population intakes. And finally, to discuss how "unsafe" we are and how to get safer.

Definitions

Free and Added Sugars: Free sugars have been defined as "all monosaccharide's and disaccharides added to food by the manufacturer, cook or consumer, plus sugars naturally present in honey, syrups and unsweetened fruit juices. Under this definition lactose when naturally present in milk and milk products are excluded [4]."

In contrast, added sugars are defined as the sugars added to foods during processing or preparation but exclude naturally occurring sugars present in intact fruit, vegetables, or dairy products or in juiced or pureed fruit and vegetables [5]. Therefore, the difference between the free and added sugars is the inclusion of juiced and pureed fruit and vegetables in 'free' that are excluded from 'added' sugars.

Safety in health: The WHO defines patient safety as the prevention of adverse effects and errors to patients associated with health care [6]. For the purposes of this commentary, safe levels of sugar intake will be defined as those that do not lead to adverse effects in the population and will use the same outcomes used in the SACN (Scientific Advisory Committee on Nutrition) report [7-10] which were obesity, type 2 diabetes, oral and colorectal health.

Current guidelines

Table 1 summarizes the recommended intake of sugar from a number of international guidelines with evidence of different health outcomes including coronary events, increased body weight, association with type 2 diabetes, colon cancer and dental caries.

Current intake

Figure 1 graphically demonstrates the current intake of added sugars in a number of European countries and the USA. Similar data is not available for free sugars.

Table 1: Dietary Guidelines and Recommendations.

Guideline	SACN 2015 [4]	WHO 2015 [7]	DGAC 2020 [8]	AHA 2009 [9]
Recommendation	Free sugars should not exceed 5% of total dietary energy from 2 years upwards	For adults and children free sugar intake should be less than 10% of total energy intake (Strong recommendation) Reduce to below 5% (conditional recommendation)	Advise Americans consume <6% energy from added sugars.	Added sugars no more than half the discretionary calorie allowance. Women – maximum 100 calories/day (6 teaspoons). Men – maximum 150 calories per day (9 teaspoons)
Sugars (g/day) and Coronary Events	No association Moderate Evidence		Insufficient evidence for added sugars	Added sugars appear to be associated with raised triglycerides, a known risk factor for heart disease, but effects on HDL and LDL unclear
Sugars and energy intake	Effect Adequate evidence Greater consumption of sugar detrimental to health Biologically relevant at population levels in individuals not subject to energy restriction.			Higher intake of soft drinks associated with greater energy intake
Sugar intake and increased body weight		Positive association. Moderate quality evidence	Insufficient evidence for added sugars	Higher intake of soft drinks associated with higher body weight
Sugars (g/day) and type 2 diabetes mellitus	No association Limited evidence		Insufficient evidence for added sugars	
Sugar-sweetened beverages (ml/day) and type 2 diabetes mellitus	Association Moderate evidence Greater consumption is detrimental to health Association is biologically relevant			
Colon cancer	No association Adequate evidence		Insufficient evidence for added sugars	
Sugars consumed (g/day) and dental caries in mixed and permanent dentition	Association Moderate evidence Greater consumption detrimental to health Association is biologically relevant	Higher rates of dental caries when free sugars > 10% of total energy. (moderate level evidence). Lower levels of dental caries when free sugars <5% of total energy intake. (low level evidence).		

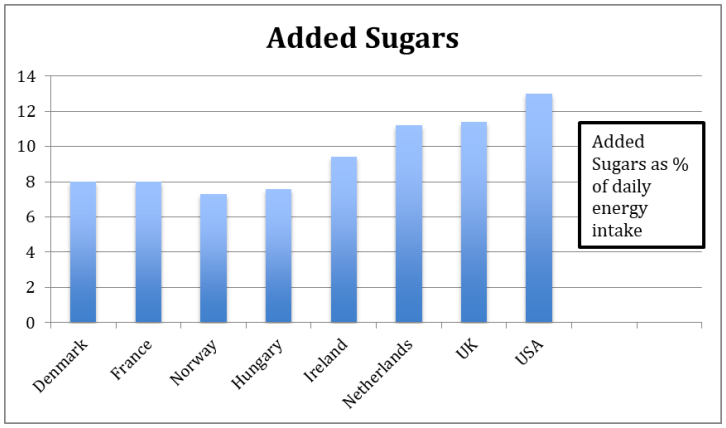

Figure 1 International levels of added sugar intake data from 8 and 10.

Discussion

The general recommendation from the analysed guidelines is to aim for an added or free sugar intake of 5 to 7% of energy intake. The SACN guidelines and WHO guidelines refer to free sugars, whereas the American DGAC and AHA guidelines refer to added sugars. Free sugars also include the sugars in pureed and juiced fruit and vegetables. Therefore the SACN and WHO criteria are stricter than the DGAC and AHA guidelines.

Above figure is international data for added sugars. It is clear that even if we use the generous guideline of the DGAC of less than 6% added sugar in comparison to the less than 5% free sugar in the SACN guideline, most western populations are consuming sugar far in excess of these levels. The UK has the highest intake of added sugar in Western Europe on the graph and the USA has over double the DGAC recommendation.

Can we measure free sugars in foods?

UK food labels report levels of carbohydrates and total sugars. The traffic light labels at the front of foods also use total sugars [11]. Total sugars are only weakly correlated with a negative impact on health and this is most consistent for free sugars in relation to weight gain, type 2 diabetes and dental caries [5]. How are consumers to make an informed choice? The ingredients may list sugars but under a multitude of different names with no quantification. Ingredients higher in the list will be in a larger quantity, but consumers are still left guessing whether the product has an acceptable level of added or free sugar.

Why have free sugars been demonised over refined carbohydrates? Rapidly absorbed carbohydrates may be present in both sugars and starches [12]. Refined carbohydrates have been associated with the obesity epidemic [13] and the risk of developing type 2 diabetes [14]. High glycaemic index (GI) and glycaemia load (GL) diets are associated with the development of type 2 diabetes [4]. However, there is difficulty translating this concept into practice. A number of issues, such as the validity and reproducibility of GI levels, the differences when foods are eaten as single items versus mixed meals, are all factors affecting the glycaemic response [15]. Protein and fibre content can particularly influence the glycaemic response. Estimating the glycaemic level of foods to be eaten involves needing to know the glycaemic index of the food and the amount of carbohydrate present in a portion. The glycaemic index may be unknown or in mixed foods, this calculation may be particularly complex.

Teta and Teta proposed a 'hormonal carbohydrate level' as being key in influencing the glycaemic response to carbohydrates eaten [16]. The hormonal carbohydrate level involves taking the total carbohydrate level in a serving and then subtracting the fibre and protein content. They suggest everyone should avoid foods with a level over 15 g, and certain people (according to scoring of metabolism that they devised) should aim for below 10 g and others below 5 g. Table has taken 6 common foods and used the traffic light system compared with the hormonal carbohydrate level using nutritional information from a UK supermarket website [17]. For the hormonal carbohydrates, levels over 15 g have been labelled as red, those over 5 g as amber and those less than 5 g as green for comparison with the traffic light system. Although this concept lacks an evidence base, the ease of calculation based on information available on food labelling is attractive [18].

According to the traffic light system, a portion of cooked oven chips would be low in sugar. However, it would cause a high spike in blood sugars in someone with type 2 diabetes. The hormonal carbohydrates of 24.8 g per serving seem more reflective of the potential effect on blood glucose. A portion of 2 Weetabix or 1 slice of white bread may also cause a blood sugar spike in those with type 2 diabetes and the hormonal carbohydrates of over 10 g again seems more reflective of this than the green level of sugar according to the traffic light system. An attempt was made to document the glycaemic load of each food item in **Table 2** however it was difficult to find the glycaemic index of many products, and portion sizes with glycaemic load varied in published tables, making the calculation very complex.

Table 2: Comparing traffic light labelling of total sugars with hormonal carbohydrate levels.

Food	Banana (per typical 150g banana)	Weetabix (per 2 biscuit serving)	Sweet and Salty Nut Bar (per1*30 g bar)	Quavers (per 16 g packet)	McCain's Oven Chips (per 100 g baked)	Hovis White Bread (per slice)
Carbohydrates	34.8 g	26 g	12.9 g	9.9 g	31 g	17.9 g
Sugars	31.4 g	1.6 g	5.8 g	0.4 g	0.7 g	1.4 g
Percentage of RDA for adults	35%	2%	6%	<1%	<1%	2%
Fibre	1.7 g	3.8 g	3.3 g	0.2 g	2.9 g	1.0 g
Protein	1.8 g	4.5 g	3.7 g	0.4 g	3.3 g	3.5 g
Hormonal Carbohydrates	31.3 g	12.1 g	5.9 g	9.3 g	24.8 g	13.4 g

Consumption of sugar-sweetened beverages is associated with a greater incidence of type 2 diabetes [18] and increased risk of weight gain and obesity [19]. Many policy documents use evidence from the effect of sugar-sweetened beverages to guide policy on free or added sugar [4-9]. But can we assume that the effect of sugar-sweetened beverages is the same as sugar-sweetened food? There is little evidence about whether the form of added/free sugar in beverages or food affects its potential to increase weight gain [20].

There is a lack of accepted analytical methods to measure added sugars and this is more complex for free sugars, where processes such as chopping, sieving and cooking will leave sugars on continuum between clearly intact and clearly free [5]. A systematic methodology to estimate added sugar content involving ten complex steps has been published [21]. However, the complexity of these calculations is beyond the capacity of most consumers. This would therefore make calculating levels of free sugars nigh on impossible for the average person.

If free or added sugars are too complex to measure and total sugars are not reflective of the glycaemic effect of food, does making policy about the recommended level of intake of free or added sugars really make sense? How are consumers meant to act on this advice? Does confusing policy actually disengage people from making healthy choices? Is questioning the safe level of free/added sugars actually the wrong question? Is the problem more basic? How do we encourage the population to have a healthier diet?

A new paradigm

Consumers are more confused than ever about what they should be eating. Prevailing popular nutrition advice may actually increase consumer confusion, scepticism and even avoidance of dietary advice [22]. Is demonising one macronutrient actually the wrong approach to improving population nutrition? The demonising of fat in the 1980s led to an increase of sugar in the diet [23]. If we restrict sugar, will consumers increase saturated fats or processed meats? Does the message to reduce free sugars with no clear route to measure them make sugars more desirable?

It is time to face the reality that the public health messaging of the last 40 years has not worked. We are in the midst of an unfolding crisis in obesity, type 2 diabetes, coronary heart disease and dental caries and a change is needed. Is it time to use the experience of other industries in behaviour change? Kotter and Solow [24] suggest an 8-step approach to create change in organisations including creating a sense of urgency, forming a powerful coalition, creating a vision for change, communicating the vision and removing obstacles. Perhaps this model could be used at a population level. The sense of urgency is increasingly important during a pandemic where COVID-19 is disproportionately affecting those with obesity and type 2 diabetes. [25]. A guiding team is required that is able to develop a system of food labelling/interpretation that is accessible to the average consumer. Clarity of message and decisive action are imperative. Could the hormonal carbohydrate level or a similar measure based on readily available nutritional information be a useful tool for the average consumer buying packaged foods? Research is needed to examine whether this would help to improve the quality of diets. Positive Psychology is an emerging area of research in healthcare [26]. The message to reduce fats and reduce sugars is not working. It has been suggested that 95% of all cognition occurs in the subconscious [27].

Thought suppression has been found to have a paradoxical effect for self-control [28]. Therefore, could asking consumers to reduce added/free sugar intake actually be having the opposite effect? Are consumers actually more likely to be thinking about added/free sugar at the time of purchase and is the decision about the purchase made in the subconscious? Is it time for a field of Positive Nutrition to emerge? Do consumers need to have a clearer message of what they should eat rather than what they should not? Positive messages could include eating more home cooked meals, choosing foods closer to the way Mother Nature made them, drinking more water, eating plenty of fresh, frozen or canned fruit and vegetables and sleeping 7-9 hours a night. It's time to create a new culture and we need empowered citizens to make changes stick.

Conclusion

Public policy documents suggest reducing free or added sugars to around 5-6% of total energy intake and yet the evidence linking free or added sugars to safety are only moderate for dental caries. Sugar sweetened beverages are linked to an increase in body weight and type 2 diabetes but it is not clear that free or added sugar in beverages has the same effect that it does in food. Refined carbohydrates also have a deleterious effect on blood sugars in people with type 2 diabetes and demonising sugar confuses this knowledge. Food labelling is inadequate to calculate either added or free sugars in food and therefore making public policy about reducing these levels seems unlikely to have significant buy-in. If we are to improve population health, is it time for a new paradigm? Can we learn from behaviour change experts in other fields and transfer their models into the world of nutrition?

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