

## **PUBLIC PERCEPTIONS OF SUGAR AND HEALTH: IMPLICATIONS FOR CONSUMPTION**

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### **INTRODUCTION**

Sugar has a long history of generating strongly held views regarding its value as part of the human diet. In fact, there is even a history of controversy as to whether it should be considered as a food. According to Dr. Claude Fischler (Directeur de recherche CNRS, Paris and the source of this historical introduction) when sugar first entered Europe in the 11<sup>th</sup> Century it was regarded as a spice with considerable medicinal properties as well as having a role as a condiment. It was scarce and highly valued both for its taste and its healing qualities, and was commonly prescribed for a variety of ailments well into the 17<sup>th</sup> Century. It was then that the greater availability and more widespread consumption of sugar first led some physicians to begin pronouncing it as the cause of various illnesses.

As early as 1606 a French physician, Joseph du Chesne, warned that sugar's whiteness hid a very dark and dangerous nature, and by 1647 one Monsieur Garencières (who was actually British) had singled out sugar as the cause of a particular form of consumption of the lungs, the disease we know today as tuberculosis. Around 1675 Dr Thomas Willis, the discoverer of glycosuria and an admirer of Garencières, declared that sugar was also the cause of scurvy, and he helped establish a firm anti-sugar trend among many of the physicians of the day.

Notwithstanding the dire warnings of some physicians and moralists, sugar continued to be highly appreciated by many and its consumption in Europe continued to grow. By the end of the 19<sup>th</sup> Century sugar was no longer a rare spice or valued condiment but an essential commodity within most households. It was also at the end of the 19<sup>th</sup> Century that the health promoting aspects of sugar were most highly touted, especially in Germany and France. In some circles sugar was being promoted as an essential nutrient, and experimental all-sugar diets were being advocated for soldiers and athletes.

Not surprisingly, the sharp rise in sugar consumption in the last half of the 19<sup>th</sup> Century stimulated an array of detractors to come to the fore. In some circles this increase in the consumption of sugar was seen as proof of the hedonistic degradation of society, and sugar often became an easy target as the cause of many of society's ills. Following World War II, when sugar consumption again began to rise, various researchers renewed the query of whether, in fact, high levels of sugar intake could be responsible for a range of health problems. Unfortunately, many were all too quick to supply answers before the results were in. Statements like "white, pure and deadly" and "empty calories" were subsequently picked up by some nutritionists, health professionals and the press, and the still widely believed myths about the detrimental effects of sugar consumption were embedded in the public mind. Sugar was regularly being condemned well before its "scientific" trial was over.

However, the denunciation of sugar appears to have reached its height during the 1960s and 1970s. Since then years of research by scores of researchers have gone into trying to determine the effects of sugar intake on nutritional and health status. The result is that there is a consensus among most informed researchers that sugar is a safe and valuable food product, and its consumption as part of a nutritionally balanced and varied diet can be consistent with good health. Many people, however, including many influential nutritionists, physicians and dieticians still do not believe this, and there is a worrying trend among various public health policy makers in some countries to again try to single out sugar as a food product to be arbitrarily restricted.

According to the most recent estimates of FAO, there are approximately 790 million undernourished people living in developing countries. It is noteworthy that, while per caput consumption of sugar is generally not very high in these developing countries, much of the world's sugar is produced there. Given the implications it has for the demand and, thus, the supply of sugar, the issue of whether sugar is good or bad for health is of considerable significance for sugar-producing economies. Unwarranted attacks on sugar that lead to a decrease in its production and trade in both domestic and international markets can, therefore, have far-reaching social and economic consequences. An important element in the efforts to counter such threats is an understanding of the current knowledge about the role of sugar in health and disease, and this paper aims to provide an overview of this knowledge.

### **CURRENT SCIENTIFIC KNOWLEDGE**

Over the past thirty-plus years intensive research into sugars, carbohydrates and dietary fibres has led to significant strides in our understanding of the metabolism and physiological effects of these dietary components. A number of epidemiological, cohort and case-control studies have delved into the relationships between carbohydrate consumption, including that of sugars, and health status, and many earlier concerns have been clarified. Our understanding of dietary behaviours and related outcomes among different populations and age groups has also increased dramatically during this time. To bring these findings together and to help make use of them for protecting and promoting nutritional well-being and health, FAO and WHO convened a Joint Expert Consultation on Carbohydrates in Human Nutrition in Rome in April 1997.

In preparation for this consultation extensive literature reviews on non-communicable diseases and all aspects of carbohydrate digestion, absorption, metabolism, and behaviour were examined by a group of experts from thirteen countries. These examinations included sucrose (table sugar) and the different sugars contained in the myriad of foods in world diets. In brief, the results, based on solid scientific grounds, dispelled the generally negative myths about the consequences of sugar consumption. The Report of the Consultation and its Recommendations has been widely disseminated as hard

copies available from the Food and Nutrition Division of FAO, and it is also available on the Nutrition page of the FAO Website on the Internet ([www.fao.org](http://www.fao.org)).

Selected findings about sugar and health from this Consultation and other sources are discussed below.

### **SUGAR DOES NOT MAKE PEOPLE FAT**

In high-income countries there is great public health concern about the rising prevalence of obesity within many population groups. In the richest countries, more than 25% of the population can be considered obese, but its prevalence is also rising in the developing countries, even among the poor in some instances. Since obesity is a key factor in the aetiology of several degenerative diseases, the understanding of the role of sugar as a food energy source is therefore of great importance.

Maintaining stable body weight requires that total energy consumed be balanced against total energy spent. Therefore, excess energy consumption in any form will promote body fat accumulation. When it is realised that dietary fats and oils have over twice the food energy value of sugars, it becomes clear that the major risk factor for obesity is excess dietary fat, not carbohydrates or sugar. Coupled with this unequal energy contribution is the fact that carbohydrate is the preferred energy source of the body. That is, carbohydrates are oxidised first and leave the more easily accumulated fat as the excess energy source.

Interestingly, findings generally show an inverse association between the intake of sugars (total sugars) and obesity and fat intake. Indeed, epidemiological data from a number of countries show that people with higher sugar intakes are less likely to be obese than those with lower sugar intakes. Also, there is no conclusive evidence indicating that the sweetness of sugar contributes to increased appetite. In fact, the opposite is generally true: the body tends to have a much better appetite-reduction response to carbohydrates and sugar than it does to dietary fat.

In summary, the consultation found no evidence to implicate either sugar or starch in the promotion of obesity other than their contribution to total energy intakes.

### **SUGAR DOES NOT CAUSE DIABETES**

Table sugar, or sucrose, is made up of one molecule of glucose linked with one molecule of fructose. Once eaten, the chemical bond is split and both sugars follow different absorption and metabolic pathways. Following ingestion of digestible carbohydrate, serum glucose increases, which stimulates the release of insulin from the pancreas. This hormone signals and assists the cells of the body to absorb glucose, thus reducing its concentration in blood. In diabetic patients this control mechanism is impaired and serum glucose levels tend to rise and stay elevated leading to the condition known as hyperglycaemia or high blood sugar. There are two types of diabetes. Type I, or insulin dependent diabetes mellitus (IDDM), is the classic form in which insulin is insufficient or totally lacking. In Type II, or non-insulin dependent diabetes mellitus (NIDDM), insulin is present and released into the blood but the body's cells do not respond to it. The immediate results are the same – high levels of serum glucose.

Historically, given the apparently logical link between dietary sugar and serum glucose levels, much attention was given to helping diabetic patients regulate their sugar intake. However, we now realise that many factors influence the rate of increase of serum glucose following consumption of sugar and other carbohydrates. These include such factors as the type of food, as well as the type of carbohydrate, consumed and levels of physical activity. Among the more important discoveries about carbohydrate over the past twenty years has been that some of it is not absorbed at all in the small intestine and becomes fermented in the colon. This carbohydrate that goes to the colon contributes little energy and is not glycaemic.

A system, called the glycemic index (GI), has been devised to rank foods empirically on the basis of their ability to contribute to increased blood glucose levels. It is particularly interesting to note that while pure glucose is the most glycaemic food, sucrose is not highly glycaemic. In fact, it is surprising to learn that sucrose is rated below maize, rice, wheat and potatoes. This is due to the high amount of fructose, which has a very low GI, present in sucrose. The use of the GI has totally transformed dietary advice for many diabetics who are generally encouraged to consume foods with a low glycemic index. As a result, diabetics are allowed to consume even sugar, generally up to 50 grams per day.

The cause for non-insulin-dependent diabetes (NIDDM) is insulin resistance at the cellular level, also referred to as glucose intolerance. Sugar intake is not the cause of the development of this clinical state. In fact, the most important contributing factor towards the development of NIDDM is obesity.

Epidemiological studies show that high percentages of NIDDM are found in all population groups undergoing rapid cultural changes and changes from traditional diets. There is no doubt that genetic factors are involved even though the precise mode of inheritance has not yet been established. Diet and lifestyle-related conditions, which lead to obesity, will clearly influence the risk of non-insulin deficient diabetes.

The main disease management feature for this condition focuses on reduction of excess body-weight and avoidance of obesity. This is generally accomplished through a combination of increased physical activity and promotion of low-energy, low-fat diets based on a wide variety of cereals, vegetables and fruits, emphasising those with a low glycaemic index. Important dietary advice for diabetics is to achieve and maintain a healthy body weight, remain in energy balance at a high level of physical activity, and to ensure that the intake of carbohydrates is evenly distributed throughout the day.

Sucrose and other sugars are not directly involved in the aetiology of either insulin-dependent or non-insulin dependent diabetes.

### **SUGAR DOES NOT CAUSE CARDIOVASCULAR DISEASES**

Attempts to understand the results of early studies on the metabolism of sugar lead to concern that glucose was not being used for energy or the production of glycogen (the storage form of glucose in the body) but rather for the production of fatty acids and triglycerides. It appears, however, that carbohydrate is not readily transformed into fat by the body but contributes to obesity through a fat-sparing mechanism. In other words, carbohydrate is the first choice of the body as a source of energy and is oxidised preferentially. Fat tends to be oxidised only when available carbohydrate has been oxidised first. Ingested fat, in contrast to carbohydrate, can contribute directly to fat stores.

The expert consultation reported that genetic factors are involved in the aetiology of coronary heart diseases and influence both the atherosclerotic and thrombotic processes underlying clinical manifestations of this disease. Dietary factors may influence these processes directly or via a range of cardiovascular disease risk factors. Obesity, particularly when centrally distributed in the body, is associated with an appreciable increase in the risk of coronary heart disease. There is also evidence implicating specific nutrients and, in particular, the high intake of some saturated fatty acids, which appear to be promoters of coronary heart disease. On the other hand, there is increasing evidence that a range of antioxidant nutrients provide strong, protective effects. Increasing carbohydrate intake can assist in the reduction of saturated fat, and many fruits and vegetables, rich in carbohydrates, are also rich in several antioxidants. Cereal foods rich in non-starch polysaccharides have been shown to be protective against coronary heart disease in a series of prospective studies. There is no evidence that sucrose plays a causal role in the aetiology of coronary heart disease.

The cornerstone of dietary advice aimed at reducing the risk of coronary heart disease is to increase the intake of carbohydrate-rich foods, especially cereals, vegetables and fruits rich in non-starch polysaccharide, while reducing the intake of fat. Among the overweight and obese, it is important to reduce total fat intake while encouraging the consumption of appropriate carbohydrate-containing foods. There has been concern that a substantial increase in carbohydrate-containing foods at the expense of fat might result in a decrease in high-density lipoprotein and an increase in very low-density lipoprotein and triglycerides in the blood. There is, however, no evidence that this occurs when the increase in carbohydrate results from increased consumption of vegetables, fruits and appropriately processed cereals, over prolonged periods.

### **SUGAR INTAKE DOES NOT LEAD TO MICRONUTRIENT DEFICIENCIES**

Table sugar (sucrose) has been labelled a food consisting of only "empty calories". Some people believe that, if used in substantial quantities, it might replace other nutrients in diet. While it is true that refined sugar does not contain micronutrients, examination of nutrient intake data does not indicate that there is a risk of becoming mineral or vitamin deficient even when higher intakes are recorded. For example, among men of different ages in the United States, consuming widely differing amounts of sugar (less than 26g, up to more than 60 g/1000 kcal/day), only fibre intake was reduced slightly in high sugar diets. In fact, high sugar consumers are more likely to reach at least two-thirds of their recommended dietary allowance of essential vitamins and minerals than are low sugar consumers.

As to fat intake, the data showed a marked decrease in the higher intake group. The supposition that sugar automatically replaces foods rich in micronutrients, adversely altering micronutrient intake, therefore, is without foundation.

### **SUGAR DOES NOT CAUSE HYPERACTIVITY IN CHILDREN**

The notion that sugar consumption adversely affects human behaviour has circulated widely for many years. By mid-20<sup>th</sup> century sugar was associated with the condition called "tension fatigue syndrome" and some twenty-five years ago sugar consumption was purportedly related to a condition called "functional reactive hypoglycaemia". One of the most common assumptions today about sugar is that it leads to hyperactivity (a "sugar high") especially among children.

The strong belief in the relationship between sugar and anti-social behaviour has led to several studies trying to identify a correlation between sugar intake in children and hyperactive behaviour. However, the experts of the consultation, after discussing an extensive review of the scientific literature on sugar and behaviour produced for the meeting, declared that there was no evidence to support the claim that refined sugar intake has any significant negative influence on either behaviour or cognitive performance in children. In fact, sugar consumption generally has a calming effect on children, and may actually improve memory, sleep patterns and appetite control.

### **FREQUENT SUGAR CONSUMPTION CAN LEAD TO DENTAL CARIES**

Dental caries affect the hard tissues of the teeth. Bacteria-producing plaque (the accumulation of sugar and other carbohydrate foods in a dense mass on the teeth) are responsible for the formation of acids which demineralise the hard tissue of the teeth.

The expert consultation confirmed that the incidence of dental caries is influenced by a number of factors. Foods containing sugars or starches may be easily broken down by alpha-amylase and bacteria in the mouth and can produce acid, which increases the risk of caries. Foods with a high glycemic index produce more pronounced changes in plaque pH than foods with a low glycemic index. However, the impact of these carbohydrates on caries is dependent on the type of food, frequency of consumption, degree of oral hygiene performed, availability of fluoride, salivary function and genetic factors.

Regarding dental health, the most important observations emerging from the recent epidemiological studies and reviews is "that more and more populations are characterised by a decreasing caries prevalence in the young generations, mostly

independent from intake of sugars and other carbohydrates". All these findings call for a less biased and more rational approach to the relationship between sugar, carbohydrates and dental caries and clearly confirm that prevention programmes to control and eliminate dental caries should focus on fluoridation and adequate oral hygiene, rather than on sucrose intake alone.

#### **CONCLUSION: THE MYTH REMAINS, BUT SCIENCE GAINS**

The firmly held opinions of many people about sugar and the harmful consequences of its consumption are often difficult to change, even in the face of compelling research results. For many, among both the public and some nutritionists, the myth regarding the dire consequences of sugar remains and will take some time before it changes. However, dispelling this widely-held "sugar is deadly" myth, and thereby allowing sugar to be recognised as a legitimate component of people's diets, can be important objective of nutrition education. At the heart of the matter is the simple notion that sugar is an inexpensive source of energy that helps make a variety of foods taste better. This can be of particular significance, for example, in regard to child feeding where energy density and taste are of paramount concern. Sugar can play an important role in improving child-feeding practices, but often concerted nutrition education programmes will be needed to overcome outmoded or prejudiced views about its appropriateness.

In recent years, the metabolic and physiological effects of sugar consumption have become better understood. Simply stated: eating sugar is not deadly. It does not cause obesity, diabetes, cardiovascular disease, hypoglycaemia, hyperactivity, cancer or lead to micronutrient deficiencies. On a positive note, sugar is a tasty, low-cost energy source that helps make a variety of foods more palatable and desirable. Given the widespread prevalence of undernutrition (chronic energy deficiency) throughout the world, the positive contribution that sugar can make to increasing energy intakes among the poor should be stressed. Concurrently, the role that sugar can play in combating obesity by lowering the energy density of high-fat diets should also be noted.

The ultimate aim of nutrition education programmes is to promote adequate access to and consumption by all people of the food they need for an active and healthy life. Obviously, sugar can make a valuable contribution to meeting one's energy needs, directly, and to enhancing the taste and appeal of a number of other foods as well. However, it is also important to recognise that in many countries the sugar industry, itself, can make a valuable contribution to improved nutrition. This happens through the sugar industry's impact on economic development and income generation which are necessary to alleviate poverty and provide the social services needed to promote better nutrition for all.

Correcting the years of misguided dietary advice about sugars will require concerted and consistent efforts in nutrition education. However, what is needed (at least from the nutritionist's perspective, if not that of the sugar industry) is not a specific sugar campaign, but rather a straight-forward, comprehensive approach that deals with the total diet and strives to provide scientifically sound and culturally appropriate dietary guidance for the population. Such approaches need to recognise that there are neither good nor bad foods, *per se*, but that there are good and bad diets. Even so, the "goodness" of a particular diet can only be judged in light of a number of other variables (basal requirements, physical activity, food types and combinations, etc.). The result is that there is no single optimal diet suitable for all people or cultures. The underlying truth of the matter is simply that all foods can be part of a healthful diet.

This goes for sugar as well, and it is now firmly established that moderate levels of sugar intake are fully consistent with healthful dietary intakes. It is, therefore, clear that efforts to limit sugar to low levels of intake (such as the commonly quoted figure of <10% energy) for an entire population are unfounded and totally unnecessary. In addition to being wasteful of time and resources, such efforts also squander consumer goodwill and contribute to the further marginalization of nutrition and health educators. There is much work that needs to be done in the areas of dietary guidance and nutrition education, and if real progress is to be made in dealing with the serious issues of concern to nutrition and health, it is important that the fight against the dietary phantom of sugar should cease.