

# SUGAR AND OUR DIET



This document is a summary of a report produced by the New Zealand Sugar Company Limited in association with the New Zealand Nutrition Foundation. A full copy of the report can be downloaded at [www.nzsugar.co.nz](http://www.nzsugar.co.nz)

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## Introduction

There is no disputing the fact that we all consume sugar in one form or another. Sugar is an integral part of the foods we choose to eat and is ingrained in our culture. However, it is also one of the most misunderstood foods, with many outdated beliefs surrounding the role of sugar in a healthy diet.

There are benefits in including some sugar in our diet. This report is an overview of current scientific understanding of sugar, the risks associated with high intakes and the role of sugar as part of a healthy diet.

## The facts about sugar

There is an ever-growing body of scientific evidence showing that the many ills attributed to sugar are inaccurate. The whole issue was thoroughly explored by an international FAO/WHO Expert Committee in 1997. To quote;

*“eating sugar does not cause obesity, diabetes, cardiovascular disease, hyperactivity, cancer, micronutrient deficiencies, and is only one factor in causing dental caries. Sugar is a tasty, low-cost energy source that helps make a variety of foods more palatable and desirable. Efforts to limit sugar intake to low levels are generally unnecessary.”*

The committee members that contributed to this report were amongst the world’s pre-eminent nutrition researchers.<sup>1</sup>

## The sugar refining process

Sugar is a natural product and the process it undergoes from sugar cane to sugar crystals

involves no addition of artificial flavourings, colourings or preservatives.

Sugar cane is grown in tropical countries and most of New Zealand’s supply comes from Queensland, Australia. The processing of sugar cane begins in the mill where the cane is crushed. The juice is then filtered and boiled to form raw unrefined crystals.

Refining removes any further impurities and clarifies the liquid sugar before it is crystallised. A wide range of sugar



products such as granulated sugar, caster sugar, icing sugar, brown sugar, golden syrup and treacle are then able to be produced.

## The nutrition of sugar

Sugar is a member of the carbohydrate family. For most of the world’s population,

carbohydrates are an important source of energy, sugar accounts for around 10–12% of all carbohydrate produced worldwide.<sup>1</sup>

Carbohydrates include simple sugars (glucose, fructose, galactose, sucrose, lactose) and complex carbohydrates, primarily polysaccharides.

- Fructose is found in many fruits and in honey.
- Glucose in small amounts is found in some plants, while sucrose (commonly known as sugar) is found in sweet root vegetables such as beetroot and carrots.
- Maltose is formed from starch during digestion as well as in brewing.
- Lactose is found in milk and milk products having been synthesised by the mammary gland from glucose and galactose.

The energy content of carbohydrate foods is similar to protein foods while fat provides over twice the energy content.

Carbohydrate	4 kcal per gram 17 kJ
Protein	4 kcal per gram 17 kJ
Fat	9 kcal per gram 37 kJ
Alcohol	7 kcal per gram 29 kJ

## How carbohydrates are digested

Most carbohydrates are broken down into glucose with excess glucose being stored as glycogen in the muscles. Carbohydrate is digested through the following process:

**In the mouth** – Salivary amylase starts the hydrolysis of starch to simple sugars.

## The GI Factor of Common Foods<sup>2</sup>

### HIGH GI > 70

White Bread, 1 slice	70
Medium boiled potato, 1	88
Fruit Roll-up, 1	99
Soda Crackers, 3	74
French Bread, 30g	95

### INTERMEDIATE GI 55-70

Basmati Rice, boiled, 1 cup	58
<b>Sucrose, 1 tsp</b>	<b>65</b>
Digestive Biscuits, 2	59
Weet-Bix, 2	69
Ice Cream, 2 scoops	61

### LOW GI < 55

Medium sliced apple	38
Baked Beans in Tomato Sauce, 1 cup	48
Orange Juice, 1 cup	46
Cooked White Spaghetti, 1 cup	41
Snickers Bar, 59g	41

**Stomach** – The controlled release of food into the small intestine occurs for further digestion and absorption.

**Small intestine** – Pancreatic amylase and enzymes in the brush border breaks disaccharides into monosaccharides.

Glucose and galactose are rapidly transported across the wall of the intestine while fructose is more slowly absorbed.

**Liver** – Sugars are transported to the liver via the portal blood stream. Glucose is then converted to glycogen for liver and muscle storage or it may be converted to fatty acids.

**Blood** – The absorption of carbohydrates stimulates insulin release from the pancreas. Insulin promotes the formation of glycogen and fatty acids.

## Glycaemic Index

Carbohydrates were originally classified by their chemical structure. Although this appears logical it did not take into account of how they are packaged in plant sources and therefore how different types of carbohydrates react in the body – specifically how they are digested and the effect on blood glucose levels.

To compare foods according to their true physiological effect on blood glucose the term glycaemic index (GI) was devised.<sup>2</sup> This index is often used in the planning of food intakes for people with diabetes.

The GI value of foods is simply a ranking of foods (0–100) based on their immediate post ingestion effect on blood sugar levels compared to glucose. Food with a lower GI causes a slower, more gradual rise in blood glucose compared to food with a higher GI. Carbohydrate foods that break down quickly during digestion have the highest GI values.



The classification of carbohydrate foods showed some surprising results. Sucrose was found to be a food with a moderate GI value, not the high GI value it was expected to have.

## Understanding nutrition labelling and sugar content of foods

Lack of understanding about the sugar content of foods can be compounded if nutrition information on food labels is misinterpreted. From January 2003 the Joint Australia New Zealand Food Standards Code will become the sole set of Food Standards for New Zealand and Australia. This requires most packaged products to display detailed information regarding nutritional content, including total carbohydrate and total sugar content which includes all naturally occurring and added sugars that are present in foods and drinks.<sup>3</sup>

## Recommended intakes of sugar and other carbohydrates

The New Zealand Nutrition Taskforce (1991) recommended that total carbohydrate provide greater than or equal to 50% of total energy intake for the general adult population, and that sucrose and other free sugars should be no more than 15% of total energy.<sup>4</sup>

The FAO/WHO expert committee recommended that a variety of foods should provide the carbohydrate in the diet, not a single or small number of sources. They recommended that a wide range of foods containing carbohydrate be consumed to ensure that the diet is sufficient in both essential nutrients and total energy. They also recommended that a moderate intake of sugar-rich foods could help provide for a palatable and nutritious diet.<sup>1</sup>

In New Zealand there is no specific recommendation for the amount of sugar we should consume, however our nutrition guidelines state that we should limit the amount of foods containing sugar. The National Heart Foundation's nutrition statement on Carbohydrates and Dietary Fibre recommends that we choose a variety of carbohydrate based foods and use only small amounts of highly sweetened foods or drinks.<sup>5</sup>

In Australia, the Nutrition Taskforce of the Better Health Commission developed a specific recommendation for refined sugar to be no more than 12% of total energy intake. This was in line with several overseas health authorities, which recommended as an achievable goal that between 10 and 12% of total energy be derived from refined sugar. Such recommendations are difficult to monitor, as most food composition data does not differentiate refined sugars from total sugars.<sup>6</sup>

Sugar and foods containing a significant amount of sugar are included in the "eat least" part of the food pyramid. This is in keeping with overseas recommendations that sugar contributes 10 to 12% of our total energy intake, approximately 1050 kJ (250 kcal) per day for an adult who might consume 8400 kJ (2000 kcal) per day. This could equate to around 15 teaspoons of sugar, but the reality is that adults would

## Sugar terminology

The term "sugars" is commonly used to describe all of the mono and disaccharides. "Sugar" however, usually describes purified sucrose, as do the terms "refined sugar" and "added sugar".

The following terminology is also commonly used to describe different sugars:<sup>10</sup>

<b>Total sugars</b>	all naturally occurring and added (refined) sugars that are present in food and drinks.
<b>Natural sugars</b>	sugars that are naturally occurring in foods, such as fructose in fruits, vegetables and honey and sucrose in fruits and vegetables.
<b>Refined sugars</b>	all sugars added to foods and drinks either in commercial or domestic food preparation e.g. corn syrup, molasses, honey, fructose, sucrose and maltose. Some people perceive sugars such as molasses and honey to be nutritionally superior to sucrose. Nutrition analysis shows there is no significant difference.
<b>Discretionary sugars</b>	all refined sugars that are added to beverages, breakfast cereals and other foods at the table. This is almost exclusively sucrose.

consume this sugar as part of the wide range of foods eaten throughout the day.

## Current sugar intakes

When looking at sugar intakes of populations we are usually using data which include the total intake of sugars. However, it is sometimes interpreted as being only the sugar that is added to foods or even sucrose. The reality is that it is quite difficult to distinguish between the two, as our food composition data does not differentiate between total and added sugar. Only by having a 100% accurate recipe for a product and any ingredients that may make up that sub-product can we know what proportion is natural or added sugar.

### New Zealand

The National Nutrition Survey in 1997 found the total sugar intake in New Zealand to be as follows (total sugars was described as the total available sugar, the sum of mono and disaccharides):

- 114g–131g for males and 99g for females per day.
- The percentage energy from total sugar was 20% (19% for males and 21% for females) for the total population.
- The most predominant sugar contributing to overall sugar intake was sucrose – 62g males and 45g females.
- The highest intakes of sugar and sucrose were seen in those 15–25 years of age with a lower intake seen thereafter.<sup>7</sup>

The first ranked source of sucrose was sugars/ sweets group (29%) of total sucrose intake; followed by non-alcoholic beverages (23%).<sup>7</sup>

### Australia

The 1995 National Nutrition Survey in Australia found that total sugars contributed 19.4 % of adult energy intake, remarkably similar to the findings of the New Zealand Nutrition Survey in 1997. The most highly refined sources (jams, sugar, honey, syrups) contributed just under 8%, well below the upper level recommended of 12%.<sup>6</sup>

Internationally there have been some serious errors in estimates of sugar consumption. A review of some of the earlier estimates of sugar intake in countries such as the US, UK and Australia has shown that sugar intake was not as high as had originally been thought. These overestimates were largely due to the fact that the information used was based on data of 'food available for consumption per head of population', which has a high margin of error.

Data on sources of intake of sugars are only available for developed countries. These data show that similar proportions of sugars are derived from cereal products, milk products and beverages, between countries. There is some variation in the proportions derived from fruit and confectionery, with the UK consuming less fruits and higher amounts from confectionery than countries such as the United States, Australia and New Zealand.<sup>1</sup>

## Sugar and micronutrient intakes

Studies in Australia and the United States showed that very high intakes of sugar were not associated with any significant micronutrient risk.<sup>8,9</sup>

In addition, a review of data from intake surveys from both the US and the European Union showed no consistent or nutritionally meaningful variation in micronutrient intake across the range of sugar intakes. The U shaped association between sugar intake and nutrient adequacy of the diet suggests that extreme intakes of sugar are not optimal. However, adequate nutrient intakes are associated with a wide range of



sugar intakes and those consuming low amounts of sugar tend to consume more energy from fat.<sup>10</sup>

## Sugar and our health

### Influence of sugar on food intake and body weight

People who are attempting to reduce their body weight frequently reduce sugar intake as a means of reducing total energy intake. However, some research suggests this may be a false economy and that including small amounts of sugar in an eating plan that has an overall reduction in energy may have significant psychological benefits.

Food intake is regulated by the complex interaction of psychological and physiological events associated with ingestion. When reducing total energy, and therefore food intake, the inclusion of sweet foods can significantly increase satiety and therefore

the likelihood of an individual maintaining an eating plan that reduces energy intake.

### Obesity

The hypothesis that sugar plays a key role in the development of obesity is a subject of debate for a number of reasons:

1. Sugars suppress appetite to the same extent as other carbohydrates.<sup>11</sup>
2. There is no relationship between the per-capita amount of sugar available in the food supply and incidence of obesity in the population.<sup>12</sup>
3. Epidemiological studies show a direct relationship between obesity and fat intake.<sup>13</sup>

It is important to remember that excess energy in any form will promote body fat accumulation and that excess consumption of low fat foods, while not as obesity-producing as excess consumption of high fat products, will lead to obesity if energy expenditure is not increased.

### Physical Activity

Most athletes and sports people have increased energy and carbohydrate requirements. Sugars have an important role to play in the diet of athletes and sports people. Sugars are a concentrated energy source so will add energy to the diet without bulk and are also a more rapidly absorbed source of energy which can be important to replenish blood glucose and muscle glycogen stores following an event.<sup>14</sup>

### Carbohydrate and Behaviour

One of the major claims against sugar is the assumption that it causes hyperactivity in children. This hypothesis was widely supported by experts and parents alike in the seventies when the

Feingold Diet was first mooted. Although it remains a belief of many, an extensive review of the literature in this area concluded that there is no evidence to support the claim that refined sugar intake has any significant influence on either behaviour or cognitive performance in children.<sup>15</sup>

### Diabetes

Until the last few decades sugar was assumed to be the cause of diabetes – mainly because diabetes results in a disorder of blood sugar levels and the sugar we consumed was thought to be directly linked to this. High and excessive intakes of sugar may contribute to insulin insensitivity and also to increases in blood lipids.<sup>16</sup>

A review of studies concluded:

- If sucrose intake has an effect on insulin sensitivity it appears to be in diets with

high intakes of sucrose i.e. sucrose intakes >30% of total energy intake.

- Fructose, not sucrose, may in fact be the cause. Therefore, further investigation is needed. People with hypertriglyceridemia and hyper-insulinaemia or both may be more susceptible to the adverse effects of high fructose or sucrose intakes. This research could have important implications as high fructose corn syrup is increasingly used as a sweetener.<sup>16</sup>

For people with diabetes current dietary advice is that moderate amounts of sugar can be included in the daily eating plan as part of a mixed, balanced and healthy diet.<sup>17</sup>



#### Dental caries

There is no doubt that sugar and carbohydrate foods play a role in the development of dental caries. However, the incidence of dental caries is influenced by a number of factors. Foods containing sugars or starch

may be easily broken down by amylase and bacteria in the mouth and can produce acid, which increases the risk of caries. Starches with a high glycemic index produce more pronounced changes in plaque pH than low glycemic index starch, especially when combined with sugars.<sup>1</sup>

In addition, 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.<sup>18</sup>

Prevention programmes to control and eliminate dental caries should focus on fluoridation and adequate oral hygiene, and not on sucrose intake alone.

### Recommendations

On balance sugar has a valuable role to play in our diet and efforts to reduce its intake to low levels are not justified. Most importantly, we need to focus on the total food composition to ensure the balance of nutrients and foods is appropriate.

In educating people about the inclusion of sugar in their overall diet the following recommendations provide a useful framework:

- Some sugar in a healthy and balanced diet offers many benefits including added energy, taste appeal and satiety and does not play a significant role in the development of diseases such as heart disease, diabetes or obesity.
- The palatability of foods we need to eat more of, such as breads, cereals and fruits can be increased when combined with some sugar. In turn, this may increase the likelihood of these important foods being consumed.
- For beverages, consumers should consume a range of drinks, using water as the primary means to quench thirst, while limiting intake of sweet drinks.
- Strategies to reduce the risk of tooth decay include: maintaining good oral health with regular dental checks, using a fluoridated toothpaste and consuming carbohydrate foods including sugar-containing foods with meals rather than continuously throughout the day.

Overconsumption of sugar may be one factor among others in the development of obesity. However, overconsumption of any nutrient is likely to have negative effects. Sugar is also clearly seen as one factor in the development of dental caries, however, good dental hygiene and minimising grazing on foods, especially sugary foods, can help prevent the development of dental caries while still including sugar in the diet.

Nutritionists need to be aware of the potential uses of sugar and not overly focus on their restriction. Doing so could potentially result in an increase in fat intake and consumption of alcohol.

### References

1. FAO/WHO. FAO/WHO Expert Consultation on Carbohydrates in Human Nutrition at [www.fao.org/waicent/faoinfo/economic/esn/carboweb/carbo.pdf](http://www.fao.org/waicent/faoinfo/economic/esn/carboweb/carbo.pdf)
2. Brand Miller Dr Jennie, Foster-Powell Kaye, Colagiuri Dr Stephen, Leeds Dr Anthony (1996). Dispelling Some Myths About Food. The G.I. Factor – The Glucose Revolution, Hodder, Australia.
3. Standard 2.8.1. Sugars. Joint Australia New Zealand Food Standards Code.
4. Nutrition Taskforce. 1991 Food For Health. Department of Health, Wellington.
5. Roberts D. Carbohydrates and Dietary Fibre. The National Heart Foundation of New Zealand's Nutrition Advisory Committee (March 1999).
6. McLennan W, Podger A. National nutrition survey – selected highlights in Australia 1995. Canberra: Australia Bureau of Statistics 1997.
7. Russell David, Parnell Winsome & Wilson Noela. NZ Food: NZ People. Key Results of the 1997 National Nutrition Survey. Ministry of Health. 1999.
8. Baghurst Katrina I. et al. Demographic and Nutritional Profiles of People Consuming Varying Levels of Added Sugars. Nutrition Research. Vol. 12, pp 1455-1465, 1992.
9. American College of Nutrition. Added Sugar and Diet Quality. Nutrition News Focus, April 17, 2001.
10. American Dietetic Association. Position of The American Dietetic Association: Use of Nutritive and Nonnutritive Sweeteners. Journal of The American Dietetic Association. 1998;98: 580-587.
11. Glinsmann W, Park Y. Perspective on the 1986 Food and Drug Administration assessment of the safety of carbohydrate sweeteners: uniform definitions and recommendations for future assessments. Am J Clin Nutr. 1995;62 (suppl): 161S-169S.
12. Anderson G. Sugars, sweetness and food intake. Am J Clin Nutr. 1995;62 (suppl): 195S-202S.
13. Prentice A, Poppitt S. Sugar and body weight regulation. Int J Obes. 1996;20 (suppl):S18-S23.
14. Devlin JT, Williams C. Foods, Nutrition and Sports Performance: a final consensus statement. Journal of Sports Sciences 1991.
15. White, J.W. and Wolraich, M. 1995. Effect of sugar on behaviour and mental performance. American Journal of Client Nutrition 62: S242-S249.
16. Daly, M.E., Vale, C., Walker, M., Alberti, K.G.M.M. and Mathers, J.C., (1997) Dietary carbohydrates and insulin sensitivity: a review of the evidence and clinical implications. Am J Clin Nutr. 66: 1072-1085.
17. The New Zealand Dietetic Association. Position Paper: The Nutritional Management of Diabetes Mellitus in New Zealand. 1997.
18. Williams Peter. Sugar: Is There a Need For a Dietary Guideline in Australia? Australian Journal of Nutrition and Dietetics (2001) 58:1.

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