



**SUGAR
ADDICTION**
BREAKING THE CYCLE

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**WE ALL HAVE AN ADDICTION
TO SWEET-TASTING DOPAMINE-PRODUCING
SUGARY TREATS. BUT THE TREND OF
INCREASING SUGAR CONSUMPTION IS
RENDERED UNSUSTAINABLE BY THE
ALARMING RISING RATES OF “DIABESITY”.
IN THIS REPORT, WE’LL EXPLORE THE
BITTERSWEET MIX OF OPPORTUNITIES.**

PREFACE

At the first International Conference on Nutrition held in 1992, world leaders collectively pledged “to act in solidarity to ensure that freedom from hunger becomes a reality”.

At the second International Conference on Nutrition 22 years later, the commitment changed noticeably – “to eradicate hunger and prevent all forms of malnutrition worldwide, particularly undernourishment, stunting, wasting, underweight **and overweight in children ... as well as reverse the rising trends in overweight and obesity and reduce the burden of diet-related non-communicable diseases in all age groups**”.

As progress is made on the reduction of poverty and incomes in developing countries rise steadily, malnutrition as a result of excessive consumption of fat, salt and sugar has now become a global issue no less challenging than the threat of famine.

TODAY, AN ESTIMATED ONE-THIRD OF THE WORLD'S POPULATION, SOME 2.1 BILLION PEOPLE, ARE EITHER OVERWEIGHT OR OBESE, WHILE THE NUMBER OF PEOPLE SUFFERING CHRONICALLY FROM HUNGER IS AN ESTIMATED 805 MILLION.

Among the chief culprits for the so-called global obesity epidemic and the sharp increase in the prevalence of diabetes, sugar was at last recognised for what it was, though it had been a suspect since the 1960s.

It is a truth almost universally acknowledged that sugar-sweetened beverages are the easiest means of adding empty calories and gaining weight. But one does not need to be sipping Coca-Cola or chewing on a favourite marzipan bar to fall prey to sugar. From fibre-rich cereal to fat-free yogurt, from old-fashioned ketchup to exotic teriyaki sauce, one finds added sugar in 80% of the foods in our supermarkets, including many of the perceived “healthy” varieties.

But change will occur, even if slowly. Nationwide education campaigns about the health dangers of excessive sugar consumption, more transparent food labelling requirements, and a cautious but visibly increased use of various forms of sugar taxes are beginning to alter consumers’ psychology and affect their behaviour.

So, one of the curious minds at Platinum, Constance Zhang, decided to explore some of the opportunities presented by these new trends and put together a sugar-coated note entitled “*Who Wants to Play Candy Crush*”.

The interesting thing we have observed is that while there is an increased offering of “sugar-free” and “low calorie” foods and drinks, they are not “non-sweet-tasting”.

PEOPLE ARE NOT ABANDONING THEIR SWEET TOOTH (IF IT WERE ONLY SO EASY TO GIVE UP AN ADDICTION!), BUT ARE INSTEAD LOOKING FOR ALTERNATIVES THAT HAVE A REDUCED IMPACT ON THEIR LIVERS AND WAISTLINES.

There is ample room for product innovation and natural sugar substitutes like stevia appear to be fast overtaking the synthetic incumbents.

I believe Constance has pulled together a fascinating study of *an investment theme*. It will give you a sense of how a theme can sprout various leads that one can follow to develop investment ideas. *Note how multi-faceted this single idea becomes as one teases out whole groups of companies that are affected by the prevalence of this natural craving by consumers.*

I hope this provides you with some interesting ideas for your portfolio or at least has value in relation to one’s behaviour – investing and lifestyle!

KERR NEILSON

Managing Director
August 2015

WHO WANTS TO PLAY CANDY CRUSH?

THERE ARE FEW FOOD ADDITIVES AS UNIVERSALLY ADDICTIVE AS SUGAR. THE EXPANSIVE CANE PLANTATIONS IN BRAZIL AND ON THE CARIBBEAN ISLANDS ARE NO LONGER TOILED BY SLAVES IN SHACKLES, BUT YOU AND I AND JUST ABOUT EVERY OTHER CONSUMER IN THE WORLD APPEAR TO HAVE BECOME ENSLAVED BY SUGAR.

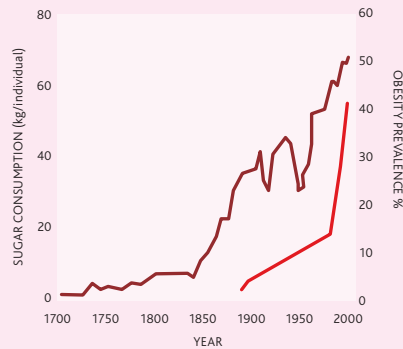
The average Englishman in 1700 consumed just 1.4 kg of the precious spice. By 1800 it had risen to 10 kg¹ and by 1900 annual consumption of sugar was as much as 45 kg per head.²

On a world-wide basis, sugar consumption averaged 5 kg per person per year at the beginning of the 20th century.

Today, 24 kg of sugar (including high intensity sweeteners) are consumed per person per year,³ with average consumption in some developed countries exceeding 60 kg!⁴

Our growing sweet tooth has given birth to many corporate giants in the past two centuries.

TOTAL SUGAR INTAKE VS. OBESITY PREVALENCE (1700 TO 2000)



Source: Johnson et al, The American Journal of Clinical Nutrition 2007; Bank of America Merrill Lynch

Leaders in the confectionery and beverages space such as Mondelez International (formerly Kraft Foods), Hershey and Coca-Cola have amassed fortunes from a variety of sweet-tasting dopamine-producing treats.

However, with growing public awareness of the health dangers that come with excessive sugar consumption, in particular, the steep rise in obesity and diabetes prevalence, will this trend last, and at what socio-economic cost?

WILL CONSUMERS EVENTUALLY EMBRACE A REDUCED-SUGAR DIET AS THEY HAVE GRADUALLY COME TO SHUN CIGARETTE SMOKING?

If so, how will industry adapt to consumers' shifting relationship with sugar and other sweeteners, and what opportunities does it present?



WHERE DOES SUGAR COME FROM?

Sugars are types of carbohydrates. They include monosaccharides which are the simplest sugar compounds (glucose, fructose and galactose) and disaccharides which are formed when two monosaccharides are joined together (sucrose, lactose and maltose). Sucrose or table sugar, for example, is essentially half glucose and half fructose.

Sugar molecules are present in many plants, with canes and beet roots being the two great sources of sucrose.

OF THE 180 MILLION TONNES OF SUGAR PRODUCED WORLDWIDE A YEAR, AROUND 80% COMES FROM CANES WHILE BEET SUGAR ACCOUNTS FOR THE REMAINING 20%.⁵

Canes thrive in tropical and sub-tropical climates and sugar was the first commodity, other than precious metals, shipped to Europe in commercial quantities from the colonies in Central and South Americas.⁶

Today, Brazil produces more than 20% of the world's sugar, with India being the second largest producer at 15%.⁷

The first challenge to sugar canes' dominance came from beet roots. The extraction of sucrose from beet roots was discovered by German chemist Andreas Marggraf in 1747, but it did not

become commercialised until the British blockaded sugar imports to continental Europe from the Caribbean during the Napoleonic wars.

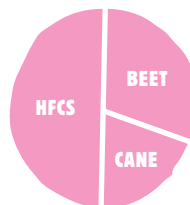
Industrial processes to extract sugar from beets were developed and by 1880 beet had replaced cane as the main source of sugar on the European Continent.

The strategic importance of this temperate crop was well appreciated by the French, Germans and Russians alike and protectionist policies for the beet industry have continued in Europe ever since.

The EU today produces around 50% of the world's beet sugar⁸ while Russia and US each produces around 1/8.⁹ Beet sugar accounts for around 78% of the total sugar and isoglucoseⁱ market in Europe, with cane sugar accounting for around 17%, almost the reverse of the cane/beet – 80/20% split on a world total basis.

The status quo may soon be shifting for European cane refineries (e.g. Tate & Lyle) as EU beet producers (e.g. Tereos, Südzucker, Nordzucker) start to enjoy loosened beet quotas and pricing policies from 2017.¹⁰

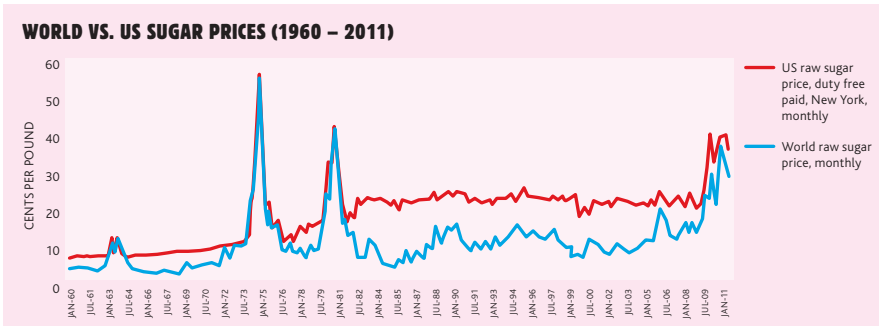
In the US, beets account for around 55% of the total sugar produced while canes account for 45%.



HOWEVER, IF HIGH FRUCTOSE CORN SYRUP (HFCS) IS ADDED TO THE EQUATION, THE BEET/CANE/HFCS SPLIT WOULD BE AROUND 28/22/50%.

i: "Isoglucose", also known as glucose-fructose syrup, accounts for the remaining 5%. The most common type of isoglucose is high fructose corn syrup or "HFCS".





Source: USDA; SugarCane.org.

Like many other countries, the US has long used quotas and tariffs on the production, importation and marketing of sugar to support domestic prices. Its policies also included extending favourable loans to sugar growers and processors.

AS A RESULT, US SUGAR PRICES HAVE TYPICALLY BEEN WELL ABOVE WORLD PRICES.

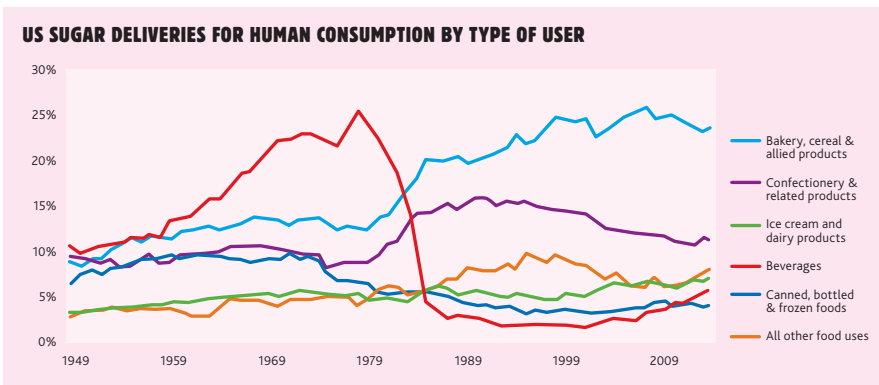
When sugar prices sky-rocketed in the mid-1970s, food and drink manufacturers looked for an alternative, more affordable sweetener, preferably one that was produced locally in the US.

The ideal alternative they found was HFCS. It is one of the products (along

with corn starch, ethanol, etc.) derived from the wet milling of corn. Corn starch is first converted to a syrup that is nearly all dextrose. Enzymes are then used to isomerise the dextrose to produce a syrup with 42% fructose and 53% glucose (HFCS-42).

Further processing produces a 55% fructose syrup (HFCS-55) which has a similar level of sweetness to sucrose.

HFCS was rapidly introduced into many processed foods and drinks. Even more appealing than the liquid, syrupy texture of HFCS and its ease of use as an additive, was HFCS' affordability, supported by an abundance of government-subsidised locally-produced corn.



Source: USDA; Platinum

HFCS' share of the US sweetener market jumped from 5% to 44% between 1975 and 1989.¹¹ HFCS-55 became the dominant sweetener for the beverages industry in the US and sugar's share dropped sharply.

In 2002, American soft drink manufacturers used 8 billion pounds of HFCS, but only about 200 million pounds of sugar.¹²

The Coca-Cola Company and PepsiCo replaced sugar with HFCS in their US-produced soft drinks – saving hundreds of millions of dollars a year, while the versions produced overseas continued with the original recipes.

HFCS REMAINED LARGELY A US PHENOMENON, WITH 55% OF WORLD TOTAL CONSUMED IN THE US AND MORE THAN 60% PRODUCED THERE.

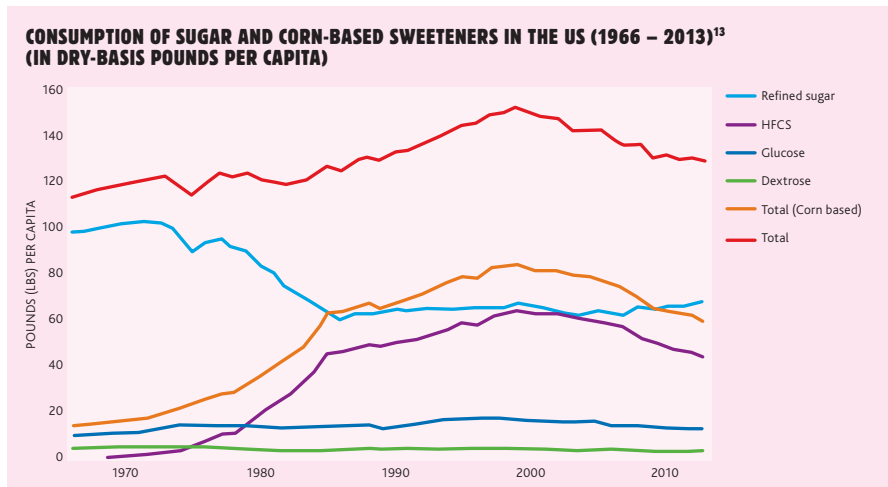
Consumption of HFCS peaked in 1999 and has since fallen slightly as a result of increasing concerns that its effect on weight gains may be even worse than sugar or sucrose (see below for detail).

Companies such as Archer Daniels Midland Company, Cargill Inc and Staley (now owned by Tate & Lyle), which enjoyed a golden age in the 70s-90s through innovating with corn sweeteners, are now facing reduced demand as negative publicity around HFCS and soft drinks led the beverages industry to react to changing consumer sentiments a few years ago.

In 2009, PepsiCo introduced three new soft drinks in the US. The marketing campaign for Pepsi Natural, Pepsi Throwback and Mountain Dew Throwback made a point of them being “sweetened with natural sugar, a blend of cane and beet sugars”.¹⁴

In the same year, Dr Pepper also released a “heritage” version of Dr Pepper Soda that was made to the original formula and used beet sugar instead of HFCS.¹⁵

Companies such as Kraft Foods, Hunt's Ketchup, Sara Lee, Snapple, Gatorade and Starbucks also stopped using HFCS in some or all of their products.



Source: Royote through Wikipedia based on data from USDA.

HOW CAN SUGAR BE BAD FOR US?

Sugars (and other carbohydrates) provide energy to fuel cells in living organisms.

Glucose is of particular importance to humans as it is the primary fuel for the brain, which uses 10-25% of the whole body's energy.

The brain is in a constant state of metabolic activity – even when one is asleep – and is therefore carbohydrate-dependent.

This natural dependence on sugar as a key source of energy has caused humans to be hooked to sweet tasting things since the time of our hunter-gatherer ancestors.

HOWEVER, RISING PRODUCTION AND FALLING PRICES HAVE LED TO OVERCONSUMPTION IN MOST PARTS OF THE WORLD IN THE LAST CENTURY AND ASSOCIATED HEALTH RISKS HAVE NOW LED SUGAR TO BE REGARDED AS THE “NEW TOBACCO”.

An abundance of studies since the 1960s have linked excessive sugar intake to diabetes, hypertension, hypoglycaemia, cardiovascular disease and other health conditions, but early warnings were

overshadowed for years by concerns over saturated fat and its impact on cholesterol levels as well as the difficulty to prove a direct causation between sugar and specific diseases.

THE CASE AGAINST SUGAR, HOWEVER, HAS NOW BEEN PROVED BEYOND REASONABLE DOUBT WITH RESPECT TO AT LEAST TWO HEALTH HAZARDS.

After a systematic review of tens of thousands of research papers, the World Health Organisation (WHO) concluded there is “strong evidence” that **excessive intake of free sugarsⁱ is associated with dental caries (i.e. tooth decays) and unhealthy weight gain (i.e. overweightⁱⁱ and obesityⁱⁱⁱ).**¹⁶

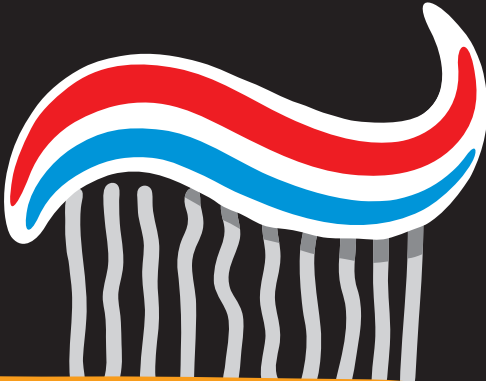
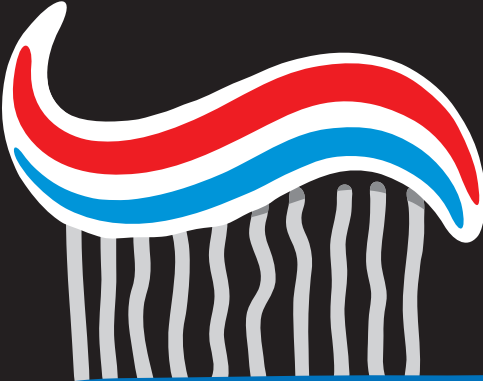
That there is a positive association between the level of free sugars intake and dental caries has been widely accepted.

Research has long shown that the acidity of sweetened drinks and the bacterial fermentation that occurs with sugar consumption can both cause dental erosion.

i: The WHO defines “free sugars” to include all monosaccharides and disaccharides that are added to foods and drinks by the manufacturer, cook or consumer. “Free sugars” include sugars naturally present in honey, syrups, fruit juices and fruit juice concentrates, but not sugars in fresh fruits and vegetables or sugars naturally present in milk.

ii: WHO’s definition of “overweight” is a body mass index of 25 or greater.

iii: WHO’s definition of “obese” is a body mass index of 30 or greater.





AROUND 68% OF AUSTRALIAN SCHOOL STUDENTS HAVE AT LEAST ONE TOOTH ERODED.¹⁷

The relationship between sugar and weight gain is not difficult to understand. When carbohydrate is consumed, sugar is absorbed into our bloodstream.

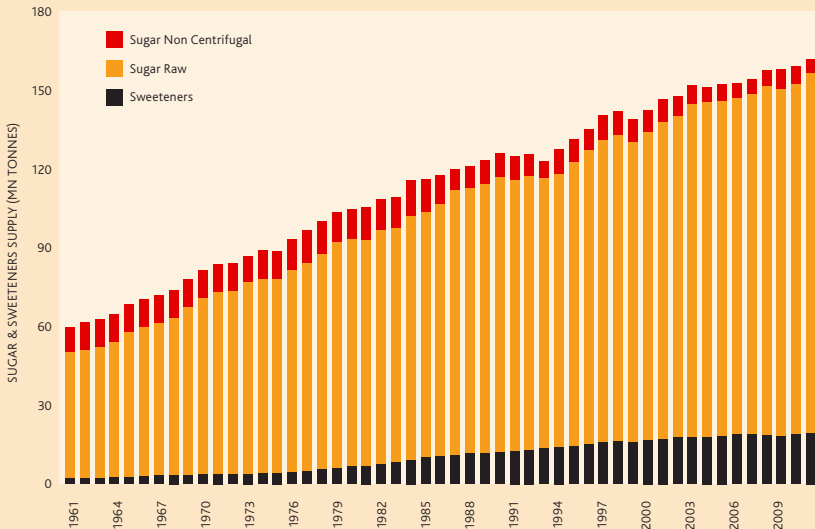
When blood sugar level rises, the pancreas releases insulin which causes the liver to convert excess glucose into glycogen which is then stored in the liver and muscles.

As these are finite spaces, the surplus is converted into fatty acids and stored in fat cells. Fat cells provide infinite storage space as they simply replicate themselves when they reach maximum capacity of fat.

It is true that obesity is an outcome of overall caloric imbalance and that overconsumption of non-sugar carbohydrates would lead to comparable weight gains. However, the palatable quality and addictive effect of sweetened foods and the effortless ways to add caloric intake in liquid form through sweetened beverages make it difficult to exculpate sugar.

Beverages are also the source of HFCS' notoriety. Sweetened beverages are estimated to account for at least 20% of the increase in weight in the US between 1977 and 2007¹⁸ which coincided with the rise of HFCS as the most widely used sweetener in beverages in that country.

GLOBAL SUGAR AND SWEETENERS CONSUMPTION HAS NEARLY TREBLED SINCE THE 1960S



Non-centrifugal sugar is a residual product obtained by evaporating the water in the sugar cane juice, it is known by many names in different parts of the world such as panela, jaggery, muscovado.

Source: FAO; Morgan Stanley Research.

Studies have suggested that the metabolism of fructose, when compared to glucose, can have a greater impact on excessive caloric intake, weight gains and metabolic syndrome because fructose does not stimulate the secretion of insulin or leptin which are signals of the feeling of fullness.¹⁹

HFCS-sweetened soft drinks provide an extremely easy means of adding extra calories without any offsetting health benefits and without suppressing the appetite to reduce the intake of other food calories.²⁰

IT IS THEREFORE IMPOSSIBLE TO DENY A CORRELATION, IF NOT CAUSATION, WHEN THE NUMBER OF OVERWEIGHT AND OBESE INDIVIDUALS MORE THAN DOUBLED FROM 875 MILLION IN 1980 TO 2.1 BILLION IN 2013²¹ WHILE GLOBAL SUGAR AND SWEETENER CONSUMPTION INCREASED BY ABOUT 60% OVER THE SAME PERIOD.

The dangers of sugar do not stop with obesity, which is widely acknowledged to be associated with other non-communicable diseases (NCDs).

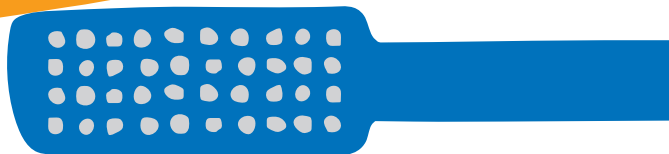
AN OBESE PERSON HAS A 9 TIMES GREATER RISK OF DEVELOPING TYPE 2 DIABETES, MORE THAN 3 TIMES THE RISK FOR HYPERTENSION, 3 TIMES THE RISK FOR COLON CANCER, MORE THAN TWICE THE RISK OF HAVING A HEART ATTACK, A 65% HIGHER RISK OF OSTEOARTHRITIS AND A 33% HIGHER RISK OF A STROKE.²²

Type 2 diabetes is a condition where blood glucose level becomes too high because the body cannot use insulin to regulate it.

Insulin is released when blood sugar levels are high, but sustained high insulin levels can lead to insulin resistance – when the body’s cells no longer respond to it.

80% of Type 2 diabetes sufferers globally are overweight or obese at the time of diagnosis.²³

The conditions of obesity, insulin resistance, metabolic syndrome and Type 2 diabetes are so closely inter-related that they have come to be collectively referred to as “*diabesity*”.





HOW MUCH IS TOO MUCH?

To be fair, sugar is not intrinsically bad for the human body. It starts to pose health dangers when one forgets the golden rule of “all things in moderation”.

The WHO recommends that the daily intake of free sugars should be kept below 10% of one’s total energy intake and “a further reduction to below 5% per day would provide additional health benefits”.²⁴

These recommended intake levels include sugars naturally present in honey, syrups, fruit juices and fruit juice concentrates (even though some of them might not be

considered “added sugar” according to commercial lingo), but not sugars in fresh fruits, vegetables or milk as “these have not been shown to have adverse effects”.

TO GIVE SOME CONTEXT, 10% OF AN ENERGY INTAKE BASED ON AN AVERAGE ADULT DIET OF 8700 KJ (OR 2078 CALORIES), WHICH IS THE STANDARD REQUIRED ON FOOD AND BEVERAGE LABELS IN AUSTRALIA,²⁵ IS ABOUT 52G (208 CALORIES OR 13 TEASPOONS).

As you can see below, one could easily exceed the recommended daily quota by just having two of these snacks a day.

TO PUT IT IN PERSPECTIVE, LOOK AT THE SUGAR CONTENT OF SOME OF OUR FAVOURITE TREATS:

Food/Beverage	Sugar Content (g)	% of Daily Intake ⁱ	Energy (Cal) ⁱⁱ	% of Daily Intake ⁱⁱⁱ
A 35g serving of Kellogg’s Crunchy Nut Clusters breakfast cereal	10	11%	143	7%
A standard 200g tub of Ski D’Lite 99% Fat Free Mango Yogurt	28	31%	181	9%
A standard 74g serving of Peters Drumstick Honeycomb Heatwave ice-cream	19	22%	215	10%
A 65g block of Kit Kat chocolate fingers	33	36%	339	16%
A standard 375 mL can of Coca-Cola	40	44%	161	8%
A standard 250 mL can of V Green energy drink	27	29%	117	6%
A standard 500 mL bottle of Lipton Lemon Ice Tea	26	29%	111	5%
A standard 500 mL bottle of The Daily Juice Company Breakfast Juice	46	51%	193	9%

Source: Platinum

i: Based on an average adult diet of 90 grams.

ii: This is the energy content of each food or beverage item as a whole, and is not limited to energy from sugar content only.

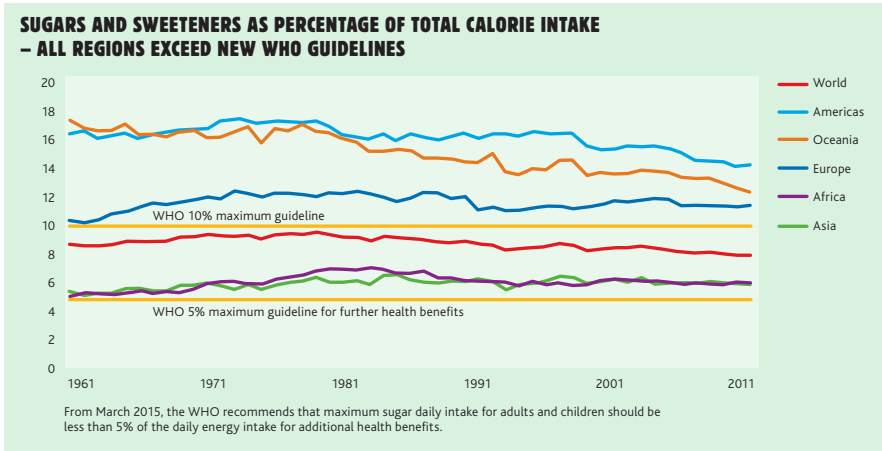
iii: Based on an average adult diet of 8700 kJ or 2078 cal.

Unless you are disciplined enough to limit your breakfast to a 35g serving of cereal and measure out the juice by a small measuring cup, it would not leave you much caloric space for a quiet beer or a glass of wine.

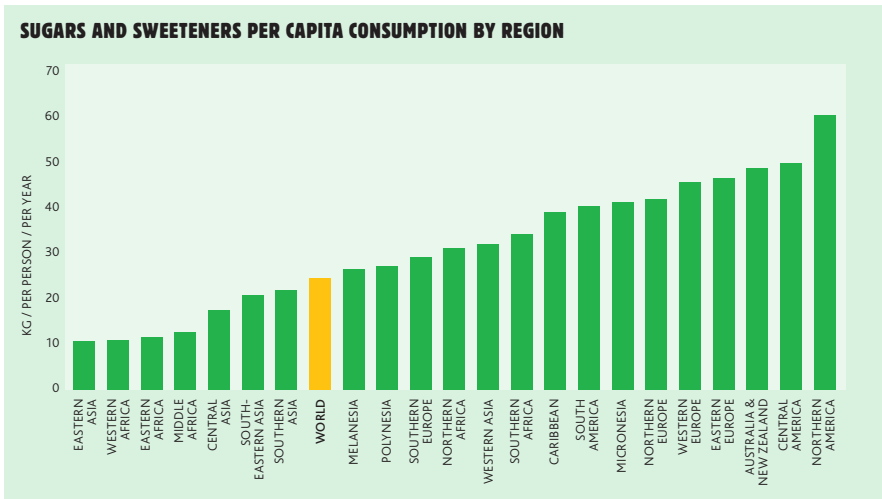
If you think we Australians are alone, or are in a club of minorities along with

other developed countries like the US, then you are mistaken.

The alarming fact is that all parts of the world, with the exceptions of Eastern Asia and Western Africa, are already at or above the WHO's recommended levels.²⁶



Source: FAO; WHO; Morgan Stanley Research.



Source: FAO; Morgan Stanley Research.

PUBLIC POLICY RESPONSE IN THE FACE OF GROWING ECONOMIC COSTS

WITH AROUND 40% OF THE WORLD'S POPULATION – SOME 2.1 BILLION – OVERWEIGHT OR OBESE,²⁷ THE WORLD IS FACING A GROWING BURDEN OF HEALTHCARE COSTS RESULTING FROM DIABESITY AND OTHER NCDs.

The global impact of obesity is currently estimated at US\$2.0 trillion or 2.8% of global GDP,²⁸ which is set to increase in the coming decades.

If diabetes-related global health expenditure amounted to US\$612 billion in 2014, how big a burden will this become if, as forecasted by the International Diabetes Federation, the number of diabetes sufferers grows by 53% over the next 20 years and every one in 10 individuals is a diabetic?²⁹

IN ADDITION, DIABESITY AND RELATED NCDs WILL ALSO HAVE A HUGE INDIRECT IMPACT ON ECONOMIC GROWTH THROUGH INCREASED MORTALITYⁱ, LOST PRODUCTIVITY AND REDUCED WORKFORCE (SEE APPENDIX).

Alarming data such as these, particularly the sharp increases in obesity prevalence among children and adolescents (47% from 1980 to 2013), have led governments to begin taking steps to address the

diabetes epidemic, part of which are aimed at reducing the consumption of sugar and other high-calorie sweeteners.

Policy responses have typically involved the following measures, all of which are aimed at altering the individual behaviour of consumers:

- **EDUCATION CAMPAIGNS**

These have been the most popular and least controversial.

Governments developed various dietary guidelines to educate the public about healthy food choices and portions and what a balanced diet should consist of.

In addition to general healthy eating campaigns, some groups have also enacted more targeted public awareness campaigns against sugar specifically (e.g. the “Pouring on the Pounds” anti-sugary drinks campaign in New York City in 2009, the “Sweet Enough Network” campaign organised by the Thai Health Foundation in 2003, and a mass media campaign rolled out in Mexico in 2012 to warn consumers about the effects of sweetened soft drinks).

i: Diabetes is currently the 8th most common cause of premature death for NCDs and is expected to move to 5th by 2030.

• FOOD LABELLING REGULATIONS

Governments have progressively adopted and tightened rules on food labelling, but not without resistance from industry lobby groups.

For example, the US Food and Drug Administration (FDA) is proposing to improve its 20-year old nutrition facts labelling requirements, including by requiring food producers to state the amount of “added sugar” as well as the total sugar amount.

Those opposing the proposal have criticised it on such untenable grounds as that the general public may not fully understand the nutrition terminology.

In Australia and New Zealand, the front-of-pack labelling scheme, known as the Health Star Rating system, is voluntary, and some big food companies are still refusing to adopt it (Mondelēz, Mars, PepsiCo, McCain, Goodman Fielder and George Weston Foods).

After much pressure from consumer advocacy group Choice, Kellogg’s has finally started to adopt the scheme for its breakfast cereals in June 2015.

• RESTRICTIONS ON ADVERTISING

Advertising restrictions are viewed as more interventionist and only a few countries (including the UK, Mexico and the Netherlands) have so far enacted laws to regulate advertising of high-calorie food to children.

However, the encouraging thing is that industry self-regulatory codes now exist in many countries and a growing number of food and beverage companies are making voluntary pledges in relation to better marketing practices.

As childhood obesity attracts greater attention, major food companies in the EU (Danone, Coca-Cola, PepsiCo, Ferrero, Kellogg’s, Mars, Nestlé, Mondelēz, Unilever, etc.) have voluntarily committed to not advertise food and beverage products to children under 12 except for products that meet specific nutrition criteria.³⁰

In the US, 17 companies are participating in the Better Business Bureau’s Children’s Food and Beverage Advertising Initiative (CFBAI), of which five companies (Coca-Cola, Ferrero, Hershey, Mars and Nestlé) have elected not to engage in advertising directed primarily at children under 12 while the other members pledged that 100% of their child-directed advertising will be for foods that meet CFBAI’s nutrition criteria.

• REGULATIONS ON RETAILING

The UK and the Australian governments adopted rules restricting the sale of soft drinks and certain other high calorie foods in schools.

Such restrictions may gradually gain traction, but are likely to be limited to sales to children and confined to a narrow range of foods and beverages on which there is wide consensus as to their harmful effects and lack of nutritional value.

If properly enforced, such “school canteen”-styled rules together with reduced child-directed advertising can play a meaningful role in helping children to form healthy eating habits which, once formed at a young age, are likely to stay with the individual for the long-run, if not for life.

It would therefore seem that policies specifically directed at improving children's caloric balance may have a far-reaching effect on reducing diabetes among the next generation and on reversing the long-term trend of the "epidemic".

• TAXES

There is always a group of critics that argue that increasing the cost of specific foods is not an effective way to discourage consumption, and that a "sugar tax" would be an unfair burden on low-income families. But evidence points to the contrary.

Mexicans consume the highest average quantity of sweetened soft drinks in the world. At 163 litres a year, the average Mexican drinks 40% more than the average American.

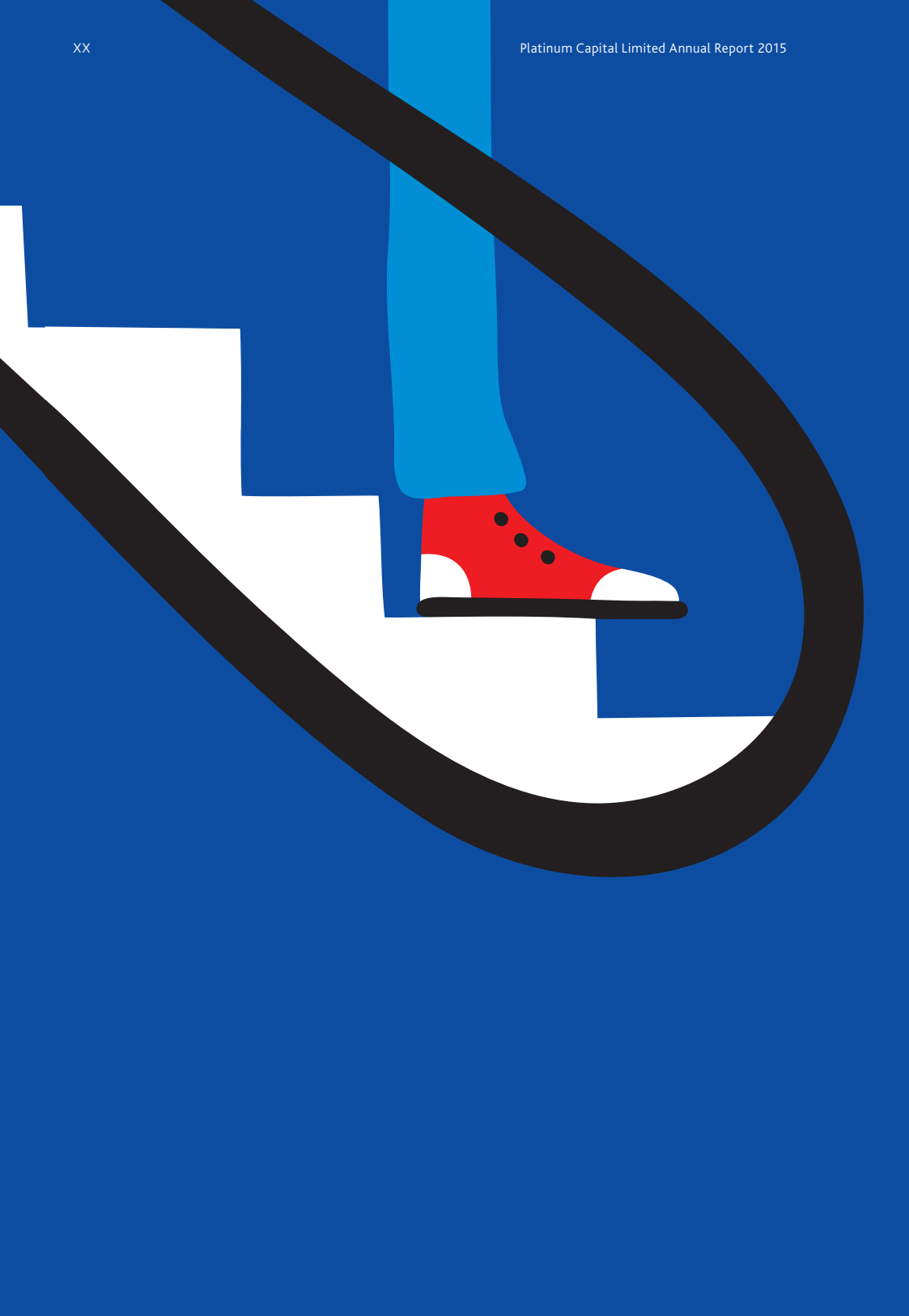
It is no surprise that Mexico also has one of the world's highest obesity prevalence (71% of Mexican adults are overweight and 32% are obese).³¹

Following the introduction of a 10% tax on soft drinks in Mexico on 1 January 2014, consumption dropped by an average of 6% through 2014, and by as much as 12% in the last part of the year.

Notably, "the effect was greatest on lower-income households, who cut their purchases by an average of 9% across the 12 months, and by 17% in the later months".³²

Controversial as taxes are, more than 10 countries (France, Finland, Norway, Hungary, India, etc.) as well as certain States in the US have enacted some form of sugar tax (usually targeting soft drinks and confectionery) as a way to combat growing diabetes (and as a revenue source), much as they have done with tobacco and alcohol.





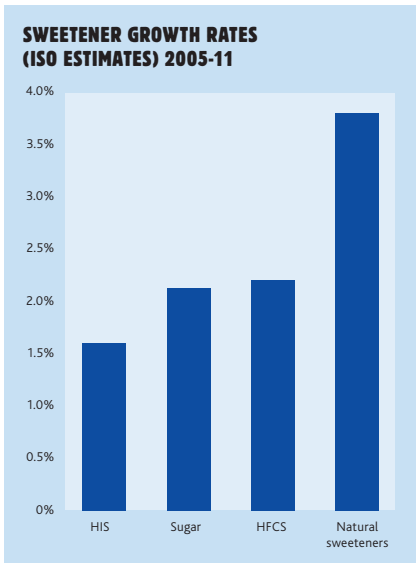
PRIVATE SECTOR INNOVATION AND LOW CALORIE SUGAR SUBSTITUTES

With growing awareness of the links between diabetes and caloric sweeteners, consumers in developed countries, as well as many developing countries, are reducing their sugar and HFCS intake, but they are not foregoing the sweet tooth.

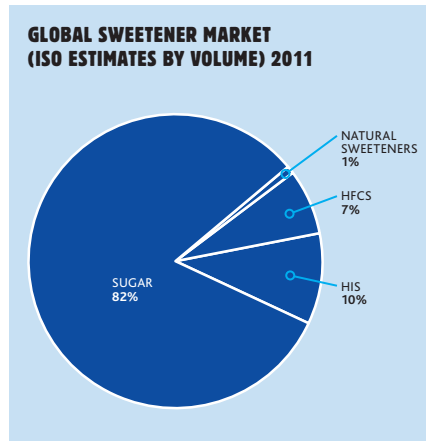
THE SEARCH FOR LOW-CALORIE ALTERNATIVES HAS PRESENTED NEW OPPORTUNITIES FOR MAKERS AND USERS OF HIGH-INTENSITY SWEETENERS (HIS), A MARKET WHICH IS EXPECTED TO APPROACH US\$1.9 BILLION IN 2017.³³

Note, however, while it is encouraging to see that growth rate in global sugar consumption has steadied and consumer preferences have begun to change in developed markets, growing global population and rising incomes in developing countries meant that overall sugar consumption is still growing at a little over 2% per year, higher than HIS' growth.

With sugar still dominating the global sweetener market by a wide margin, leading sugar producers such as Cosan and Tereos International remain strong cyclical businesses.



Source: ISO; Credit Suisse AG Research Institute.



Source: ISO; Credit Suisse AG Research Institute.

ARTIFICIAL LOW-CALORIE SUGAR SUBSTITUTES

MAJOR TYPES OF ARTIFICIAL HIS USED AS FOOD ADDITIVES AND TABLETOP SWEETENERS:

Artificial sweetener name	Relative sweetness to sugar	After taste	Calories (per gram)	Relative price to sugar for same unit of sweetness	Common brands of the sweetener	Product Examples	Top 5 sources (% contribution to intake)
Saccharin (E954)	300	Yes	0	2%	Sweet'N Low, Sweetex, Hermetasetas, Sugarine, Sugarella	Saxbys Diet Ginger Beer, Aeroplane Jelly Lite, Weight Watchers fruit in jelly.	Tabletop sweeteners (49%), cordials/fruit drinks (31%), carbonated soft drinks (16%), other desserts/breakfasts (3%), jellies/milk-based puddings (2%).
Cyclamate (E952)	40	Yes	0	6%	Sweet'N Low, Sucaryl	Cottee's No Added Sugar Cordial, Saxbys Diet Ginger Beer, Aeroplane Jelly Lite, Weight Watchers fruit in jelly.	Cordials/fruit drinks (51%), carbonated soft drinks (34%), tabletop sweeteners (4%), jellies/milk-based puddings (4%), other desserts/breakfasts (4%).
Aspartame (E951)	200	No	*4	8%	Equal, Nutrasweet, Hermetasetas-Gold, Sugarless	Bundaberg Diet Ginger Beer, Diet Coke, Diet Pepsi, Pepsi Max, Sprite Zero, Nestlé Diet yoghurt, Yoplait Forme yoghurt.	Carbonated soft drinks (66%), tabletop sweeteners (9%), sports, energy and weight management products (7%), flavoured yoghurts/mousses (7%), confectionery (4%).
Acesulfame Potassium or "AceK" (E950)	200	Yes	0	4%	Equal, Sunett, CSR Smart, Hermetasetas-Gold, Sugarless	Bundaberg Diet Ginger Beer, Coke Zero, Pepsi Max, Red Bull Sugarfree, Saxbys Diet Ginger Beer, Sprite Zero, V Sugar Free, Cottee's No Added Sugar Cordial, Ribena Light, Dairy Farmers Thick & Creamy Light, Nestlé Diet yoghurt, Yoplait Forme yoghurt.	Carbonated soft drinks (52%), flavoured yoghurts/mousses (22%), cordials/fruit drinks (9%), confectionery (7%), flavoured milks (5%).
Sucralose (E955)	600	No	^0	15%	Splenda	Bundaberg Diet Ginger Beer, Dairy Farmers Thick & Creamy Light, Cottee's No Added Sugar Cordial, Ribena Light, Red Bull Sugar Free, V Sugar Free, Protein Revival milk drink, Atkins Endulge and Advantage Bars.	Carbonated soft drinks (59%), flavoured yoghurts/mousses (13%), cordials/fruit drinks (9%), tabletop sweeteners (5%), sports, energy and weight management products (5%).
Neotame (E961)	8000	No	0	1%	Newtame	Tampico fruit juices, Atkins Endulge Peanut Caramel Cluster Bars.	N/A

* Sugar and HFCS also have 4 calories per gram, but the high intensity of sweetness of Aspartame means reduced quantity in sweetened products, and hence less calories.

^ Sucralose itself has no calories, but the bulking agent gives the end product 3 calories per gram.

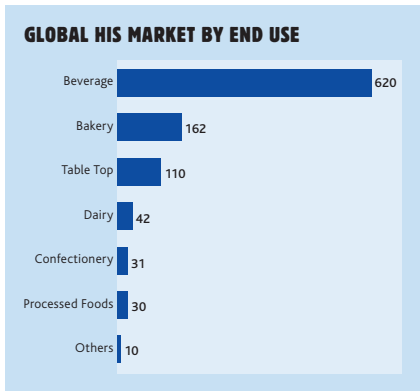
Source: Sugar-and-Sweetener-Guide; Choice; Healthier Workplace WA; CCM International; Bank of America Merrill Lynch; Platinum.

While taste, mouth feel, functions as a preservative and bulking agent are all important considerations for the HIS business, safety issues, whether real or perceived, have been the key factor affecting the success of the industry. Most of the artificial HIS mentioned above have had a chequered history of medical and legal controversy.

Aspartame’s lack of aftertaste helped it to replace Saccharin as the main sweetener used in diet soft drinks and many confectionery in the 80s, but the chemical’s side effects have increasingly come under the spotlight in recent years and many now consider it the worst of the commonly used artificial HIS.

Unlike most other artificial HIS, Aspartame is fully metabolised by the body and is broken down into aspartic acid, phenylalanine and methanol, which some claim have an effect on the brain and nervous system and can be toxic in high doses.³⁴

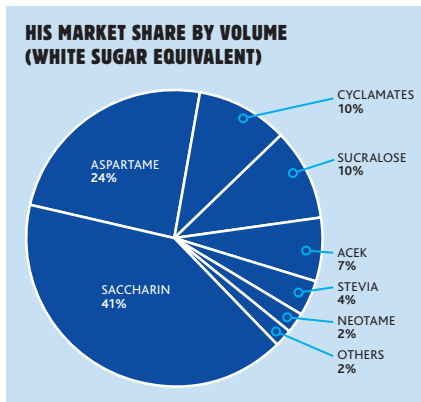
ASPARTAME’S NEGATIVE PUBLICITY ALLOWED SUCRALOSE – A HIS THAT CLAIMS TO BE “MADE FROM SUGAR, SO IT TASTES LIKE SUGAR” – TO TAKE SOME OF ITS MARKET SHARE.



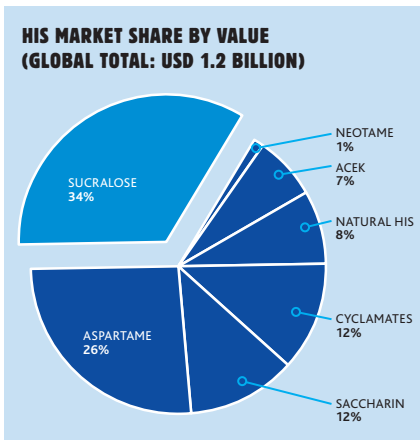
Source: LMC; Cosan Ltd.

PepsiCo, for example, announced in April 2015 that it would be replacing Aspartame with Sucralose for most of its diet drinks in the US,³⁵ but both Diet Coke and Coke Zero still use a combination of Aspartame and AceK, at least in Australia.³⁶

Health warnings for Aspartame were also a catalyst for Merisant Company’s Equal brand to diversify from its original recipe of Aspartame and AceK and add Sucralose and Saccharin varieties to its HIS offering.



Source: ISO; Credit Suisse AG Research Institute.



Source: ISO; Credit Suisse AG Research Institute.

ⁱ Sucralose’s molecular structure is a modified version of sucrose, with the three oxygen-hydrogen groups in the sucrose molecule replaced with three chlorine atoms through processing. Tate & Lyle marketed Splenda with the slogan “Splenda is made from sugar, so it tastes like sugar”. French courts recently held the slogan misleading while in the US the case reached settlement.

Tate & Lyle no longer has a monopoly on Sucralose following a loss in patent suits against several Chinese manufacturers and US distributors in 2009, but the Splenda brand still dominates supply with an 80% Sucralose market share.

The development of Neotame as a derivative from Aspartame by The NutraSweet Company also marked a shift towards greater industry interest in the HIS space – starting with Saccharin in 1878, all the other HIS listed above were discovered by accident in laboratories when the scientist was researching coal tar derivatives, pesticides or other chemicals for medical application.

Neotame’s extreme intensity (8000 – 13,000 times sweeter than sugar), low relative cost (1% the cost of sugar and 3% the cost of HFCS), and the fact that it is the only FDA-approved synthetic HIS with a “Safe” rating by the Centre for Science in the Public Interest (US), made it the fastest growing artificial HIS in the market.

With the US patent expired in July 2015, generic versions may soon be available, and more and more food and beverage manufacturers may switch to Neotame for their low-calorie product range.

Consumers may be making the switch to HIS-sweetened food and beverages for their reduced calories, but there is an added cost advantage for the manufacturers.

WHILE ARTIFICIAL HIS COST ONLY A FRACTION OF THE PRICE OF SUGAR FOR THE SAME UNIT OF SWEETNESS, RETAIL PRICES OF “DIET” DRINKS AND THE “ORIGINAL” CANE OR BEET SUGAR VARIETIES USUALLY COST ABOUT THE SAME.

It would appear that manufacturers are not passing much of the cost savings onto consumers.

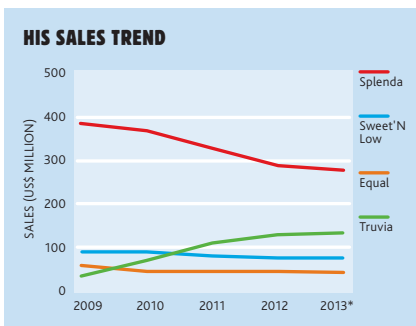
NATURAL LOW-CALORIE SUGAR SUBSTITUTES

Artificial HIS have been in the market for decades, but safety concerns (whether or not backed by solid evidence) as well as inferior mouth feel have limited their popularity (growth has been slower than sugar and HFCS).

Although they remain legal and are declared safe by regulators in various countries, the trend towards “natural diet” and “natural living” in the past two decades has accelerated the growth of natural HIS such as stevia and monk fruit at a cost to artificial HIS’ market shares.

Stevia Rebaudiana is a South American plant. Its leaves have been used as a sweetener by natives for hundreds of years. The Steviol Glycoside compounds extracted from the leaves are up to 300 times sweeter than sugar.

Not only does stevia contain zero calorie and zero glycaemic, it has also been reported to have a beneficial effect on regulating blood sugar levels and is therefore well-suited to diabetes sufferers.

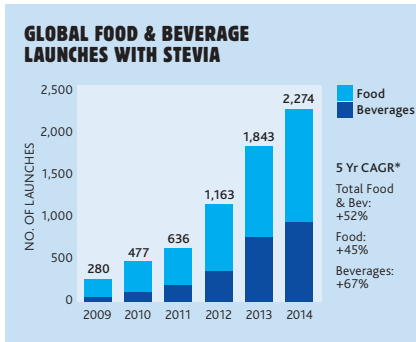


* Latest 52 weeks, ending April 21. Source: Infoscian Reviews and Information Resources, Inc. (IRI).

Stevia-based sweeteners first became commercialised in the 1970s by Japanese company Morita Kagaku Kogyo. It developed an integrated system from cultivation to extraction and refinement, and was the first to create sweeteners based on Rebaudioside A (Reb A or Rebiana), one particular Steviol Glycoside. Rebiana replaced artificial HIS in many low calorie food and beverage products in Japan and achieved a 40% market share.

In the US, stevia faced much more resistance and was banned in the 90s before the FDA finally declaring Reb A “Generally Recognised As Safe (GRAS)” in 2008 (with the EU following suit in 2011).

Stevia-based products took off rapidly after that, experiencing a 400% increase globally in 2008 – 2012.³⁷



*CAGR: Compound Annual Growth Rate.
 Source: Mintel; PureCircle.

ZENITH INTERNATIONAL ESTIMATES THAT THE GLOBAL STEVIA MARKET WILL REACH 7,150 TONNES BY 2017³⁸ WHILE THE WHO ESTIMATES STEVIA WILL REPLACE 20% OF THE US\$50 BILLION GLOBAL SUGAR MARKET.

**TOP 10 CATEGORIES:
 NUMBER OF GLOBAL STEVIA LAUNCHES 2014**

	No. of launches	% of total
1 Snacks	398	18%
2 Other Beverages	224	10%
3 Juice Drinks	223	10%
4 Dairy	218	10%
5 Sweeteners and Sugar	138	6%
6 Carbonated Soft Drinks	126	6%
7 Bakery	125	5%
8 Ready-to-Drink Beverages	123	5%
9 Sugar and Gum Confectionery	97	4%
10 Hot Beverages	94	4%

Source: Mintel; PureCircle.

The biggest hype in the beverages aisle of Australian supermarkets this year was probably the arrival of Coca-Cola Life, sweetened with E960 or Steviol Glycoside.

No one could have missed the stacks of green cans with their accompanying signs of “35% reduced sugar & kilojoules”.

A stevia-sweetened, “30% less sugar” version of Pepsi NEXT is also being rolled out in crisp green cans in select countries (Australia, New Zealand, Canada, etc.).

Be careful now. There is a trick. These new mid-calorie range soft drinks contain both sugar and stevia.

This may be due to stevia’s liquorice-like aftertaste. According to Tereos PureCircle Solutions, a major supplier of stevia-based sweeteners, out of the 604 new products containing stevia extracts launched in 2010, 60% still contained sugar,³⁹ and many food manufacturers continue to experiment and search for recipes that hit the right balance between reduced calories and uncompromised mouth feel.

More broadly, much R&D is being undertaken throughout the supply chain, from plant breeding and cultivation to extraction and purification, to product formulation and marketing.⁴⁰

Start-ups such as Stevia Corp and Stevia First Corporation are investing heavily in R&D and IP acquisition to improve both yield and leaf quality.

Approximately 70,000 – 100,000 tonnes of stevia leaf were harvested in 2010, with most commercial stevia farming (estimated at 90%) taking place in China.

Leaf accounts for nearly 80% of refined stevia product cost. There is significant demand for agronomic and farm management expertise to develop high yield breeds, establish new plantations and scale leaf production.

IN THE PRODUCT FORMULATION AND DISTRIBUTION SEGMENT, THE BIGGEST SOFT DRINK COMPANIES AND THE MAJOR ARTIFICIAL HIS PRODUCERS HAVE BEEN ACTIVE LEADERS. THE DOMINANT STEVIA BRANDS IN THE MARKET ARE:

- **“TRUVIA”** – developed and marketed by Cargill Inc (privately-owned agribusiness giant and a top producer of HFCS) jointly with Coca-Cola, the sweetener is made from Reb A and Erythritol (a sugar alcohol found in small concentrations in fruits);
- **“STEVIA IN THE RAW”** – manufactured and distributed by Cumberland Packing Corp (which also owns Sweet’N Low);
- **“PURE VIA”** – another formulation developed by the Whole Earth Sweetener Company (a wholly owned subsidiary of Merisant, owner of Equal) in partnership with PepsiCo using Reb A, dextrose, etc.

The extraction and purification segment is dominated by Pure Circle Limited which has a vertically integrated supply chain with control “from leaf through production to end customer relationship and formulation support”.⁴¹

The company’s Stevia 3.0 portfolio now comprises eight sweeteners and four flavour ingredients. Reb M, a new zero-calorie sweetener from the stevia leaf jointly developed by PureCircle and Coca-Cola, was granted GRAS status by the FDA in 2013.

PureCircle currently supplies more than 90% of the high purity stevia extract in the US market (excluding the table top sweetener category).⁴² Its sales increased by 37% in volume and 44% by value from FY13 to FY14 while gross margin rose by 106%.

PureCircle also has joint ventures with Nordzucker AG and Tereos, the world’s second and third largest sugar producers respectively, to produce and distribute stevia extracts and sweeteners as well as stevia-sucrose blended sweeteners in the European and Brazilian markets.

The joint ventures, however, do not yet appear to account for a significant portion of the businesses of the two sugar giants.

GLG Life Tech is another vertically integrated producer of stevia extract with China-based plantations, processing facilities, as well as R&D centres.

In 2008 it secured a 10 year contract to supply Cargill with 80% of its stevia needs for the first five years. The relationship, however, broke down over time. GLG’s stock price fell from \$11 to less than \$1

in 2011 when the Cargill contract was renegotiated and GLG effectively lost its biggest customer.

The company appears to be slowly recovering and announced two major developments in 2014 from its patented and proprietary breeding programs.

The “Reb C Gold seedling” and the “Super RA” variety are new strains of leaf that contain high concentrations of the sweet compounds and are expected to significantly lower the cost of production. The company’s revenue is showing improvements, though it still has substantial debts and remains loss-making.

Interestingly, GLG decided in 2014 to diversify from stevia and ventured into the monk fruit extract market.

Monk fruit (or Luo Han Guo) is native to Guangxi Province in Southern China. Having been used to treat coughs and other ailments in Chinese medicine for hundreds of years, the fruit has only started to be commercially produced as a natural high-intensity sweetener in the past few years.

The sweetness of monk fruit comes from Mogrosides which make up only around 1% of the fruit by weight, but are about 300 times as sweet as sugar.

In addition to containing no calorie, it also has little aftertaste. However, monk fruit has not yet become widely available as a result of its being twice as expensive as stevia and not having obtained regulatory approval in Europe (it has recently been approved in the US by FDA, including for GLG’s Mogroside V products).

MONK FRUIT GROWS IN VERY SPECIFIC CLIMATIC CONDITIONS ONLY. THREE COUNTIES IN GUANGXI PROVINCE ACCOUNT FOR SOME 90% OF THE VERY LIMITED GLOBAL OUTPUT.

The better known brands in this nascent market include Tate & Lyle’s “Purefruit”, “Monk Fruit In the Raw” by Cumberland Packing Corp and the Japanese brand “Lakanto”.

The largest monk fruit grower and supplier is Guilin GFS Monk Fruit Corp (MFC), a Sino-Foreign joint venture founded in 2004 by a Chinese entrepreneur and New Zealand company BioVittoria Ltd.

MFC claims to have a 70% market share for the supply of processed monk fruit ingredients. It entered into a five year arrangement with Tate & Lyle in 2010 under which MFC granted exclusive global sales and distribution rights for its monk fruit extract to Tate & Lyle and the latter would develop Purefruit through sales, research and applications.

The relationship was further cemented with Tate & Lyle’s acquisition of a 12% equity interest in MFC in 2011.⁴³

Mogroside-based sweetener can be found in more than 1000 products currently, including Nestle’s Skinny Cow Creamy Iced Coffee range, Yoplait Yogurt and Juice, Hubert’s Diet Lemonade, etc.

According to MFC, other global food and beverage companies such as Coca-Cola, PepsiCo, General Mills and Kellogg’s are all working on products sweetened with monk fruit extract.

BEYOND SUGAR, COKE AND STEVIA

We have in this paper focused on the changing fortunes of sugar and other sweeteners, but rising rates of obesity and diabetes also present enormous opportunities outside of the food and beverage industry.

AN OBVIOUS BENEFICIARY IS THE PHARMACEUTICALS AND HEALTHCARE SECTOR. MORGAN STANLEY ESTIMATES THAT DIABETES IS A \$35 BILLION MARKET GLOBALLY AND IS EXPECTED TO REACH \$50 BILLION BY 2020.

Medication to treat or manage diabetes, a chronic disease, ranges from oral anti-diabetics (OAD), the glucagon-like peptide 1 (GLP-1) class of drugs and insulin, the largest segment in value.

Leading producers of insulin include Novo Nordisk (the diabetes theme accounts for approximately 80% of group sales), Sanofi (22%) and Eli Lilly.

Merck & Co, AstraZeneca, Eli Lilly, Novartis and Takeda are producers of OAD, a segment estimated to grow at a high single digit pace in the coming decade due to the continuous innovation with new classes of drugs.

Mitsubishi Tanabe is also expected to enjoy rising profits from growth in royalties for Invokana, an OAD in the SGLT2 inhibitor class (diabetes products are estimated to contribute as much as 30% of profits in 2018).

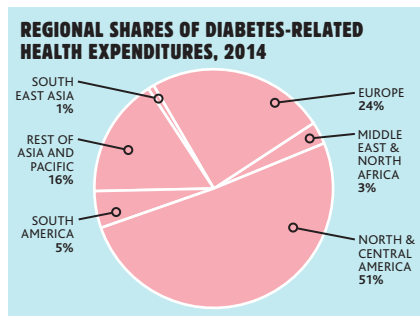
Ono Pharmaceutical also has around 25% in diabetes-related sales, predominantly from Glactiv, an OAD in the DPP4 inhibitor class.

One of the reasons that diabetes is such a serious and costly condition is its numerous complications. Persistent high blood glucose levels can cause irreversible damage to the body’s organs and diabetes is the most common cause of kidney failure (more than 40%).

When diabetes sufferers experience kidney failure, they must undergo either dialysis or a kidney transplant. Dialysis is a form of kidney replacement therapy through cleaning the blood with an artificial kidney.

In the dialysis space, Fresenius Medical Care is the current market leader with 3100 dialysis clinics and 40 production sites worldwide. The company stands to save many more lives and improve the quality of life for many of its patients in the coming years.

There is enormous demand for diabetes treatment in developing countries. More than 80% of the global expenditures were made in the world’s richest countries while 77% of the world’s diabetes sufferers live in low and middle income countries.



Source: IDF, Morgan Stanley Research



This represents a significant business opportunity for pharmaceutical and medical technology companies that are willing and able to develop the right business model and cost structure to meet the needs of diabetes patients in those developing countries.

Obesity opens up an even greater number of possibilities as there is much unmet medical need. Currently, there is only a short list of FDA-approved prescription weight-loss drugs. Novo Nordisk's Saxenda, an injectable medicine, was the latest offering in addition to Takeda/Orexigen's Contrave, Arena/Eisai's Belviq, and Vivus' Qsymia, which are pills.

These companies may be doing themselves a disservice by pricing their drugs too aggressively.

By 2018, these drugs are only expected to generate sales ranging US\$100-210 million,⁴⁴ which can hardly be considered success stories in the pharmaceutical world.

Non-prescription weight-loss products and services, on the other hand, are a fast growing market – Americans spent US\$28 billion on dietary supplements (not limited to weight-loss products) in 2010 and US\$40 billion on weight-loss programs and products.⁴⁵

GNC and Glanbia are among the companies with a high exposure to the US\$35 billion vitamins, minerals and supplements (VMS) industry, which has been growing at a compound annual rate of 5.8% over the past 10 years and is estimated to grow at 7% per year from 2010-20E.⁴⁶

Commercial weight-loss centres such as Jenny Craig and Weight Watchers as well as gym facility chains such as Fitness First are also expected to continue to grow with significant opportunities in developing markets.

HERE IS WHERE WE WILL END OUR SHORT JOURNEY IN THE CANDY FACTORY. THE TREND OF INCREASING EXCESSIVE CONSUMPTION OF SUGAR AND HFCS OVER THE PAST FEW DECADES HAD CAUSED A GROWING DIABESITY EPIDEMIC ON A GLOBAL SCALE.

In numerous countries, however, stakeholders have been alerted to the ill effects of such excesses and collective action to reverse the upward trend of diabetes is well under way.

A combination of policy and education initiatives on the one hand and product innovation on the other is beginning to produce results in some parts of the world (Mexico being an excellent example showing that positive change can occur).

There are big opportunities for food and drink producers as the natural HIS segment of the market is still at a nascent stage. It is also imperative that the healthcare industry rise to the challenge and support the growing number of diabetes sufferers. It will be a bittersweet mix for market players.

AS FOR THE MORAL OF THE STORY – SUGAR AND THE STOCK MARKET REQUIRE THE SAME KIND OF DISCIPLINE. WE MUST STRIVE TO STAND RESOLUTE IN THE FACE OF TEMPTATION AND PLEASE DO NOT SUCCUMB TO YOUR SWEET TOOTH TOO OFTEN.

APPENDIX

HOW MUCH WILL

DIABESITY

COST OUR ECONOMY?

“DIABETES IS NOT JUST A HEALTH ISSUE AND A THREAT TO OUR HEALTH SYSTEM AND SPIRALLING COSTS – IT IS MORE AND MORE AN ECONOMIC AND PRODUCTIVITY ISSUE THREATENING ...BUSINESS SECTORS.”⁴⁷

A report commissioned by Diabetes Australia places the productivity impact of diabetes in Australia currently at \$5.6 billion per year while the total estimated cost of diabetes in Australia in 2013 was \$14.6 billion (including direct healthcare, direct non-healthcare and social costs).⁴⁸

To gauge the indirect costs of excessive sugar consumption and related diabetes issues, Morgan Stanley Research conducted a series of simulated GDP and productivity trajectories for selected countries. While the multitude of variables involved gives the outcomes a high degree of uncertainty, the study nevertheless provides a valuable reference on the broader, long-term economic impact of sugar-related health problems.

The starting point of Morgan Stanley’s study is the OECD’s 2014 economic forecasts for 2015-2035, which do not take into account the impact of sugar consumption on health and assume on

average the same output per unit of labour across the economy.

The study adjusts the OECD forecasts by varying output per unit of labour based on categories of “healthy”, “diabetic” and “obese” and building in productivity assumptions of “absentees”, “presentees”ⁱ and “leavers”ⁱⁱ to the latter two categories, thereby accounting for the impact of sugar consumption on health and hence productivity. The researchers then ran the following three simulation scenarios:

- **BASE CASE SUGAR SCENARIO** – assuming no change in the propensity to consume sugar to current levels and no changes in prices;
- **HIGH SUGAR SCENARIO** – assuming an increase of sugar preference of 5 kg per person cumulatively over the 20 year projection-horizon (equating to an increase of 50kcal per person per day) and a corresponding increase in diabetes and obesity prevalence rates (150kcal/person/day increase in sugar availability translates to a 1.1% increase in diabetes prevalence, and 20kcal/day lead to a 1 kg increase in body weight over 3 years); and

i: “Presenteeism” refers to employees who go to work even though they are sick.
ii: Those who leave the labour market because they are too ill to work.

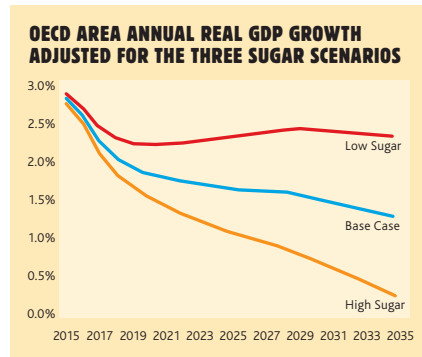
- **LOW SUGAR SCENARIO** – assuming a decrease in sugar consumption of 10 kg person cumulatively over the same 20 year period (equating to a reduction of 100kcal per person per day) and a corresponding reduction in diabetes and obesity prevalence rates.

The results of these simulations show that in the Base Case Sugar Scenario:

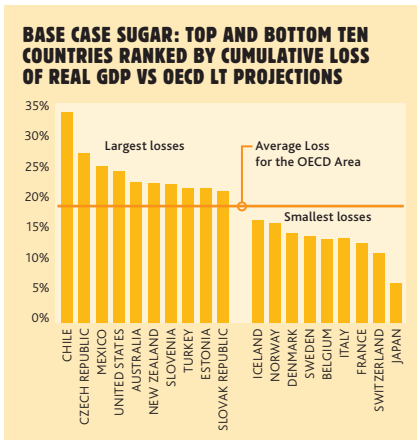
- GDP growth averages 1.8% per annum in the OECD over the 20 year period, compared to the OECD forecast of 2.3% (i.e. a cumulative loss of 18.2 percentage points); and
- Productivity growth averages 1.5% per annum in the OECD over the next 20 years, compared to the OECD forecast of 1.9% (i.e. a cumulative loss of 11.7 percentage points).

prevalence (e.g. Japan and France) face the least sugar consumption-related loss of productivity.

The potential impact of sugar consumption and diabetes on economic growth is even more startling when the three different simulation scenarios are compared side by side:



Source: OECD; Morgan Stanley Research estimates.



Note: the data shown are percentage points. LT long-term. Source: Morgan Stanley Research estimates.

The countries that face the highest output loss are those with high rates of both diabetes and obesity (e.g. Chile, the US and Australia), while countries with relatively low diabetes and obesity

In the High Sugar Scenario, GDP growth in the OECD area would slow to 1.3% per year on average, approaching just 0.3% towards the end of the 20 year period, while diabetes rate would increase from 11.6% in the Base Case Scenario to 12.0% and obesity rate would nearly double to 60%.

In contrast, the Low Sugar Scenario would see a drop in diabetes rate to 10.9% and the obesity rate would fall towards zero, which would translate to an average GDP growth of 2.2% per annum over the 20 year period.

THIS SERIES OF SIMULATED PROJECTIONS INDICATE THAT, ALL ELSE BEING EQUAL, DIABETES AND OBESITY PREVALENCE CAN HAVE A SIGNIFICANT IMPACT ON PRODUCTIVITY AND ECONOMIC GROWTH OVER THE LONG RUN.

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