

facts



Taste enhancement
in new sugar reduced
beverage concepts

Jungbunzlauer

*From nature
to ingredients®*

Introduction

The beverage industry in Western countries is changing. The industry must cope with changing consumer behaviour on the one hand, and governments and consumer protection groups that jointly seek to reduce the widespread overconsumption of sugary drinks on the other. This changing environment puts immense pressure on beverage manufacturers to reconceptualise and reinvent their range of products to a larger extent than has been seen in recent years.

For some years now, governments have been closely following the developments of nutrition-based disease statistics. The soaring overweight and obesity rates of recent years as well as the strong increase in the prevalence of diabetes are alarming, as these bring with them considerable socio-economic costs and are thus detrimental to the whole of the society. It is scientifically safe to say that one part of the problem is the high sugar consumption of the population. Governments are spending large sums of money in order to finance educational campaigns for healthy food and drinks in schools and other public institutions. They also promote physical exercise and ban vending machines and advertisements aimed at children. All steps have been taken in order to halt and reverse the aforementioned trends, and to reduce excess sugar consumption, especially through beverages. However, these campaigns have so far not produced the desired results. Consequently, governments have begun imposing excise taxes on products containing excess amounts of sugar – the ultimate tool for steering the markets. In countries such as France, Hungary and Finland, but also the USA and Mexico, excise taxes on sugary drinks are already a reality. Although such taxes are primarily borne by the consumer, they also pose a serious threat to the main product lines of many beverage manufacturers today: the taxes are a strong motivator for the consumer to switch from sugary drinks to healthier products.

Table 1: Examples of excise taxes on beverage products

Country	Year of introduction	Rate of tax in 2016
Hungary	2011	Soft drinks: ~£0.02 per/L Syrups or Energy drinks: ~£0.64 per/L
France	2012	Sugared and non-sweetened drinks: ~£0.059 per/L Energy drinks: ~£0.79 per/L
Finland	2011	Soft drinks; sweets and ice cream: ~£0.17 per/L, ~£0.75 per/kg
Mexico	2014	Sugary drinks: £0.04 per/L
US (California)	2014	Sugar sweetened beverage: ~£0.24 per/L

Source: Health-related taxes on foods and beverages, Food Research Collaboration, 2015

After many years of critical analysis, it has become obvious that the consumer, too, is finally starting to realise that excess sugar consumption in general, but also through beverages, is potentially damaging to their health. Taxes imposed by governments are reinforcing this understanding. Aside from that, the consumer is more interested and more aware of what is in their beverage instead of sugar. There is growing awareness that traditional artificial sweeteners are supposedly a risk to health as well. This constitutes a further challenge for the beverage industry, as consumers are now not only becoming wary of and avoiding sugar, but also the common sugar alternatives, namely artificial sweeteners.

As a consequence, beverage manufacturers are confronted with shrinking markets not only in the traditional sugar-based sector, but also in the diet sector. The beverage giants, in particular, are suffering from declining consumption. Only through innovation they can regain the customers who are switching to waters and juice-, tea- and coffee-based drinks. Innovation, however, will only succeed if it is based on sweeteners that do not incur excise taxes and those that are trusted by the consumer. But most importantly, these innovative concepts must meet the consumer's taste expectations, otherwise the products will fail.

ERYLITE® – a new type of flavour enhancer

Jungbunzlauer offers a powerful taste enhancer that can easily support any beverage innovation process: ERYLITE® Erythritol.

ERYLITE® is a fermentation-based polyol that was most recently approved for use in beverages as a flavour enhancer in the European Union. The maximum allowable amount is 1.6% (w/w) in energy-reduced flavoured drinks or those with no added sugar. The fermentation based production qualifies ERYLITE® to be considered the only natural polyol approved for use in food and beverages. From a physiological point of view, it is a very interesting additive, as it has both a zero caloric value and a zero glycemic index. It therefore does not increase the calorie load and is also safe for diabetics. More importantly, it is a highly effective flavour enhancer. On its own, ERYLITE® imparts a clean, sweet flavour that resembles the taste of sucrose. When used in beverages, ERYLITE® significantly improves the flavour:

- 1) ERYLITE® significantly improves the taste of sweeteners based on steviol glycosides. Stevia plant extracts always impart a characteristic taste profile even at the highest purity levels. That taste profile is characterised by liquorice, with occasional bitter notes, and a lingering effect that is hard to ignore. Although steviol glycosides have improved in flavour over recent years, ERYLITE® significantly mitigates the remaining unpleasant notes and eliminates the lingering effect. This effect is still observed even on steviol glycosides with the highest concentrations of rebaudioside A. The positive effects of ERYLITE® are not limited to stevia extract, but are also perceptible when used with traditional sweetening alternatives.
- 2) ERYLITE®, used at the permitted levels of up to 1.6%, exhibits some quantitative synergies on sweetness with common sweeteners, of which steviol glycosides are a great example. When used in combination with stevia extracts rich in rebaudioside A, the sweetness of the combination of stevia extract and ERYLITE® is higher than the sweetness imparted by stevia extract alone. This is partly because ERYLITE® also imparts a mild sweetness itself. But in a sensory test, the total sweetness perceived by the panel for a stevia extract and ERYLITE® combination exceeds even the sum of the individual sweetness contribution of both substances. A higher sweetness is clearly advantageous, as it helps to restrict the dosage and cost of sweeteners.



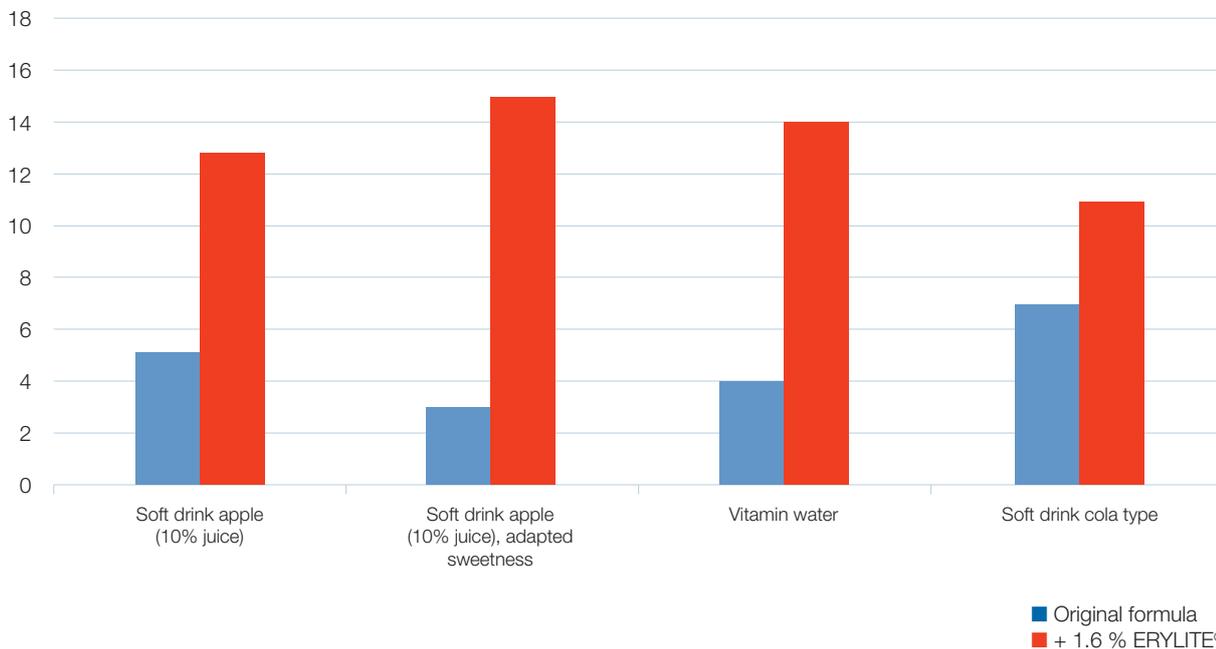
Sensory tests

The beneficial effects of 1.6% ERYLITE® can be observed in reduced-sugar versions of typical drinks, such as iced tea, cola, vitamin-enriched waters or juice-based drinks. While cola drinks are in the midst of a market crisis (regular full-sugar types but also diet versions), iced teas as well as juices and juice-type drinks are profiting from changing consumer habits and, as a result, are growing in popularity. The following test serves to demonstrate the flavour-enhancing effects of ERYLITE® on some reduced-sugar soft drinks. The various sensory ranking tests for the sensory evaluation of the samples were carried out where the panel tasted four different types of beverages over several tasting sessions in order to determine their preference of the samples.

Four products were tested:

- 1) An apple-flavoured soft drink with no added sugar (10% juice)
Sweetening system: sucralose + acesulfame K
- 2) An apple-flavoured soft drink with no added sugar (10% juice)
Sweetening system: sucralose + acesulfame K (adapted sweetness)
- 3) A low-sugar vitamin water (less than 2.5g sugar per 100ml)
Sweetening system: sugar + rebaudioside A
- 4) An energy-reduced cola soft drink (30% less energy than the full sugar version),
Sweetening system: sugar + rebaudioside A

Diagram 1: Paired comparison tests (n=18) regarding taste intensity between original formula and improved with 1.6% ERYLITE® for four different beverages



The sensory testing of the four different beverage types reveals a general trend towards a better taste and higher flavour intensity upon addition of 1.6% ERYLITE® to energy-reduced drinks. The effect differs in strength for each type. While the improvement on the cola drink is visible but not extraordinary, it is much stronger for the two apple-flavoured soft drinks and the strawberry/pomegranate-flavoured vitamin water. This is because fruity flavours are better enhanced by ERYLITE®.

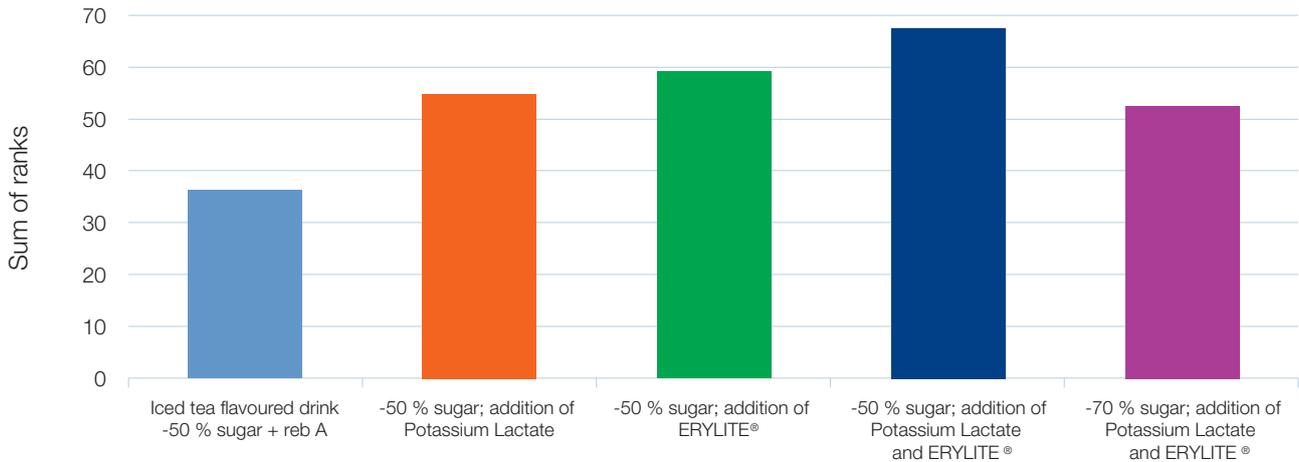
Furthermore, a difference is visible between the two types of the apple-flavoured soft drink. One version has an adapted sweetness, taking into account that ERYLITE® adds to sweetness as well. The sweetness of ERYLITE® is approximately 60% of that of sucrose. This means that just adding 1.6% ERYLITE® on top contributes the additional sweetness of about 1% sucrose. In order to produce a drink of equal sweetness, the other sweeteners must be reduced accordingly. In the present case the additional sweetness of 1.6% ERYLITE® seems to find less acceptance amongst this sensory panel. Although the benefits of ERYLITE® are manifold, including its sweetening effect, EU regulations stipulate clearly that it is solely to be used as a flavour enhancer in beverage production.

Another beverage that amply demonstrates the positive effect of ERYLITE® as a flavour enhancer is an ice tea flavoured drink. A cassis-flavoured iced tea was formulated with 50% less sugar. The sweetness is adjusted to a 100% sucrose level with rebaudioside A 97%. Using the same sensory panel setup, the drink was also tested against an upgraded version containing the maximum allowable amount of ERYLITE® (1.6%). In this setup, another substance from Jungbunzlauer's toolbox was used: potassium lactate. Lactates, neutralisation products of lactic acid, are known not only to heighten the flavour-enhancing effects of sweeteners, but also to mask the off-taste of certain sweeteners and bitterness of substances such as caffeine and minerals. The effect of potassium lactate on improving the taste of stevia extracts rich in rebaudioside A is particularly noticeable. Typically, 0.15 to 0.20% potassium lactate is added.

Table 2: Recipes of iced tea beverages

	Ingredients	Standard full sugar	Standard -50 % sugar	Standard -50 % sugar with 0.19 % Potassium Lactate	Standard -50 % sugar with 1.6 % ERYLITE®	Standard -50% sugar with 0.19 % Potassium Lactate and 1.6 % ERYLITE®	Standard -70% sugar with 0.19 % Potassium Lactate and 1.6 % ERYLITE®
1	Citric Acid Anhydrous	2.00 g	2.00 g	2.00 g	2.00 g	2.00 g	2.00 g
2	Trisodium Citrate Dihydrate	0.80 g	0.80 g	0.80 g	0.80 g	0.80 g	0.80 g
3	Rebaudioside A	–	0.10 g	0.10 g	0.10 g	0.10 g	0.14 g
4	Ascorbic acid	0.25 g	0.25 g	0.25 g	0.25 g	0.25 g	0.25 g
5	Tea extract	1.40 g	1.40 g	1.40 g	1.40 g	1.40 g	1.40 g
6	Cassis flavour	0.50 g	0.50 g	0.50 g	0.50 g	0.50 g	0.50 g
7	Sugar	65.00 g	32.50 g	32.50 g	32.50 g	32.50 g	19.50 g
9	Potassium (L+)-Lactate	–	–	1.90 g	–	1.90 g	1.90 g
10	ERYLITE®	–	–	–	16.0 g	16.00 g	16.00 g
11	Water	930.05 g	962.45 g	960.55 g	946.45 g	944.55 g	957.51 g
Sum		1000.00 g	1000.00 g	1000.00 g	1000.00 g	1000.00 g	1000.00 g

Diagram 2: Preference ranking between different sugar reduced iced tea flavoured drinks
(with rank 1= least preferred and rank 5 = most preferred)

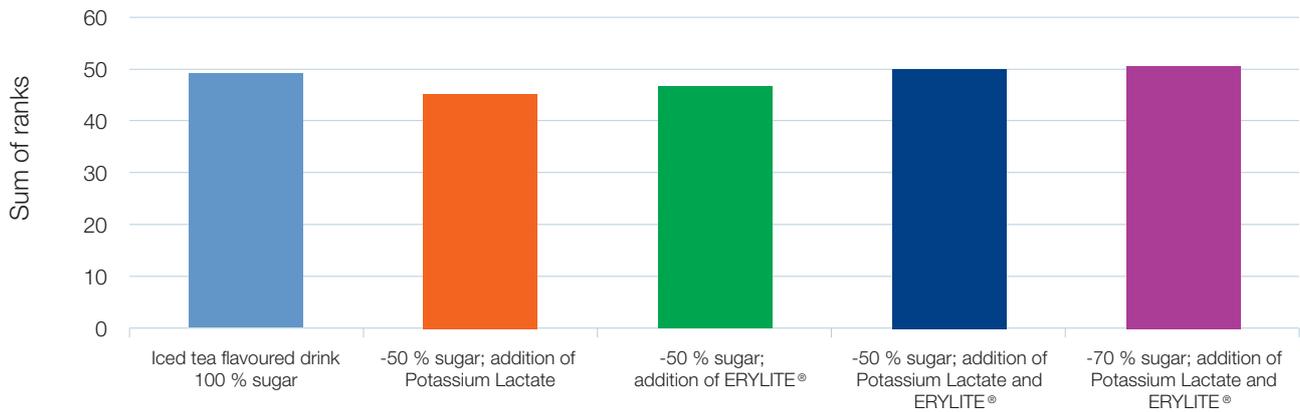


The addition of potassium lactate significantly increased the acceptance level of the reduced-sugar iced tea drink. With 0.19% potassium lactate, the liquorice aftertaste of the stevia is masked very well, which explains the improved sensory results. As expected, the addition of ERYLITE® also improved the acceptance of the drink. The effect is even more pronounced than the effect of potassium lactate. But the improvement goes beyond taste and flavour intensity. Sugar reduction not only changes the sweetness and taste of the product, it is also the mouthfeel that suffers, as the sugar is the main contributor of bulk to the drink. However, 1.6% ERYLITE® creates additional bulk, which accounts for the greater overall preference as well. Using ERYLITE® and potassium lactate together improves the drink's performance further, and clearly sets a new benchmark in terms of flavour as compared with the original formula.

Based on this convincing result, it seemed appropriate to test the combination of ERYLITE® and potassium lactate on a drink with 70% less sugar instead of 50%. The result was just as convincing, as the taste panel showed a preference again substantially higher than the original drink with 50% less sugar.

As mentioned above, one of the main difficulties in helping consumers switch to healthier reduced-sugar products is the difference in taste. Especially for long-term users of full-sugar products, the full sugar's version taste is the benchmark. The following test was designed to ascertain whether adding ERYLITE® and potassium lactate can close the taste gap between a full-sugar iced tea and the version with 50% less sugar. The result is actually quite surprising.

Diagram 3: Preference ranking between full sugar and sugar reduced iced tea flavoured drinks (with rank 1 = least preferred and rank 5 = most preferred)



The sensory results indicate that the addition of both ERYLITE® and potassium lactate improves the flavour of an iced tea flavoured drink with 50% less sugar to such an extent that the panel's preference for this version is only slightly lower than for the full-sugar version. Using both together leads to the desired result: the panel's preference is the same as for the full-sugar version. What is most interesting is that preference for the drink with 70% less sugar is also the same as for the full-sugar drink. Both products, ERYLITE® as well as potassium lactate, are thus excellent tools for improving the taste and flavour intensity and thus the overall preference of sugar reduced iced tea flavoured drinks, particularly when used in combination.

Summary

The beverage industry is under increasing pressure to introduce new, healthier, reduced-sugar beverage concepts into the market, and ones which are not subject to excise taxes. These innovations will only be accepted by the consumer if they are flawless in taste and if they use alternative sweetening systems, because traditional artificial sweeteners are raising doubts on safety among consumers.

With ERYLITE® and potassium lactate, Jungbunzlauer has two effective ingredients for significantly improving the flavour of sugar reduced beverages. In the concepts tested, they harmonise perfectly with traditional artificial sweeteners but also with rebaudioside A, the most commonly used non-artificial sugar replacer. When added to an iced tea flavoured drink with 50% less sugar, they easily outperform the original version made with sugar and rebaudioside A only. Used in combination, ERYLITE® and potassium lactate raise the performance of the drink with 50% less sugar to the same level as the full-sugar version. This is a powerful flavour enhancement method and a real aid to the innovation efforts of the beverage industry.



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About Jungbunzlauer

Jungbunzlauer is one of the world's leading producers of biodegradable ingredients of natural origin. We enable our customers to manufacture healthier, safer, tastier and more sustainable products. Due to continuous investments, state-of-the-art manufacturing processes and comprehensive quality management, we are able to assure outstanding product quality. Our mission "From nature to ingredients®" commits us to the protection of people and their environment.

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