

DOI 10.17590/20210615-084339

Assessment of the annual number of newly available products that are sweetened with fructose-glucose syrup or glucose-fructose syrup

Joint Opinion No 018/2021 by the BfR and MRI from 15 June 2021

A mixture of fructose (fruit sugar) and glucose (dextrose) is often used to sweeten foods. Depending on which of the fructose or glucose components predominates in a mixture, this is referred to as fructose-glucose syrup (contains at least 50 % fructose) or glucose-fructose syrup (contains at least 50 % glucose and more than 5 % fructose). This also includes high-fructose corn syrup (HFCS) obtained from corn starch. The syrup can contain various proportions of fructose. Compared to sucrose, it has a slightly higher sweetening power, and is more cost-effective and easier to process in food production.

The German Federal Institute for Risk Assessment (BfR), together with the Max Rubner Institute (MRI), has evaluated how often the aforementioned mixtures of fructose and glucose are used in processed, newly introduced foods available on the German market. For this research, the institutes compared the results of the Mintel Global New Product Database and Innova Database, in which new product launches are being registered since 1996 and 1994, respectively.

It turns out that fructose-glucose syrup or HFCS are rarely used on the German market. Less than 1 % of all foods recorded in those databases have either one of these substances in their list of ingredients. Foods that contain them particularly fall within the categories of baked goods (e.g. bread and bread products, cakes, pastries), confectionery (e.g. chocolate, chocolate bars, fruit gums) and ready-made meals (e.g. instant noodles, instant rice, ready-made pizzas). Fructose-glucose syrup or HFCS is also added to snacks and sports nutrition, i.e. certain foods produced for those who engage in sports (e.g. bars, drinks or food supplements).

The results of both databases show that the annual new product launches on the German market to which fructose-glucose syrup or HFCS has been added have remained constant over the period under review (years 2005–2018), although this has changed since 2013 as a clear increase or resurgence of the newly registered products can be seen. In 2018, both databases had fewer new products listed than in the previous year.

Products that contain glucose-fructose syrup are much more common. These products increased steadily on the German market from 2005 to 2016 and 2017, respectively. Since then, the number of new product launches appears to have stagnated at a high level or has fallen slightly. Foods to which glucose-fructose syrup is most commonly added belong to the categories of baked goods, confectionery, desserts and ice creams, and dairy products.

Whether and to what extent recipe changes for older products already on the market are used to substitute high-fructose corn syrup or glucose-fructose syrup for household sugar (sucrose) as sweetener cannot be determined on the basis of these data.[?] Whether and to what extent recipe changes for older products already on the market are used to substitute high-fructose corn syrup or glucose-fructose syrup for household sugar (sucrose) as sweetener cannot be determined on the basis of these data. Statements on the overall trend concerning the use of either sweetener in Germany are therefore not possible. The databases can support a recording of the market with regard to the nutritional composition of pre-prepared products, but cannot replace a comprehensive survey of the current market situation.

It has been scientifically proven that regular, excessive consumption of foods with free sugars promotes the development of tooth decay and obesity, with its resulting secondary diseases. Since 2015, the World Health Organization (WHO) has therefore issued a recommendation, shared also by the BfR, that adults and children should not derive more than 10 % of their daily food energy (including drinks such as soft drinks and fruit juices) from free sugars. If possible, the consumption of free sugars should be even lower.

1 Subject of the assessment

Together with the MRI, the BfR has determined the frequency of use of fructose-glucose syrup in processed foods on the German market – based on the individual food groups and their importance in nutrition. The databases commonly used by both institutions were used for this purpose.

2 Datasets

Preliminary remark: In commercial product databases, extensive information from, among others, the food and beverage sectors is continuously recorded regarding ready-made products new on the market or in modified packaging. Every year, these databases document a large number of products selected notably due to packaging changes and the further development or supplementation of product lines to include new product characteristics such as gluten-free or vegan. As a result, recipe changes to existing products that are not associated with packaging changes or corresponding promotional claims are not necessarily newly recorded. It should also be noted that these databases do not show whether the listed products have since been withdrawn from the market. Consideration of the new or visibly changed foods and beverages from the last 5–10 years recorded in these databases allows an overview. However, this means that the German food market cannot be mapped at a specific point in time. Thus, although these commercial product databases can support an overview of the market with regard to the nutritional composition of ready-made products, they cannot replace a comprehensive survey of the current market situation.

2.1 Mintel GNPD database

The Mintel Global New Product Database (Mintel GNPD) has existed since 1996 and is a database for new product launches (Mintel 2019). Currently 33,000 products are purchased and analysed in 62 countries per month. There are currently 282,193 products (as of: 04.07.2019¹) from the following areas on the German market: food, beverage, cosmetics and personal care, health, household products, and pet care. Information relevant to the present assessment can be found in Mintel GNPD in the form of packaging information, which is photographed by the buyers and catalogued in the database.

¹ In 2020, which does not fall within the observation period of this statement, 38,000 products are currently recorded per month. As of August 3, 2020, there are 307,645 products listed for sale on the German market.

2.2 Innova

The Innova Database from Innova Market Insights has existed since 1994 and is a database for new product launches. 500,000 products in 90 countries are currently recorded annually (Innova, 2019). That corresponds to around 42,000 products per month in 90 countries. The information relevant for the present assessment is available in Innova as packaging information, which is photographed by the buyers and then entered into the database.

3 Explanation of terms

Fructose-glucose syrup is produced by the isomerisation (conversion) of parts of the glucose contained in glucose syrup into fructose. The resulting syrup is called fructose-glucose syrup if it contains more than 50 % fructose. A glucose-fructose syrup, on the other hand, contains at least 50 % glucose and more than 5 % fructose. A fructose syrup consists of 95 % fructose and a maximum of 5 % glucose (Tummel et al. 2011). “High-Fructose Corn Syrup” (HFCS), on the other hand, is available in different versions as HFCS-42, HFCS-55 or HFCS-90, in which the number afterwards reflects the percentage of fructose in the mixture. On food package labelling, only HFCS or fructose-glucose syrup is specified, but not the ratio of the two types of sugar to one another. According to the Association of the Grain, Milling and Starch Industry VGMS e.V. (VGMS, 2019), no HFCS with 90 % fructose or 55 % fructose is produced in Germany. Nevertheless, there are products with the ingredient HFCS on the German market that may have been imported.

Inverted sugar syrup is defined as an aqueous solution of sucrose partially inverted by hydrolysis. Accordingly, it is produced by partially splitting sucrose into its two components and thus consists of sucrose, glucose and fructose (Bundesgesetzblatt, 2003).

4 Research strategy

Product research was carried out at the BfR using the Mintel GNPD database, and at the MRI using the Innova database. For this reason, all sections of this statement relating to the respective database have been processed by the institute responsible. The search strategy was developed jointly and carried out accordingly.

In order to be able to take into account the existing uncertainties regarding the exact composition of fructose-glucose syrup, a tiered research was carried out. A total of three levels of queries were made in the two databases.

The occurrence of the queried foods with fructose-glucose syrup (main part fructose) on the German market was revealed by the first stage of the search strategy. Other foods with the addition of glucose-fructose mixtures (main component glucose) were shown in the second

stage of the search strategy, and finally fructose or fructose syrup (fructose only) in the subsequent third stage. These stages are described in detail below. In the results section the presence of these different ingredients within the three search queries is discussed.

The following were defined as general conditions for all three search queries:

- Search period: January 2005 – December 2018 and
- Search region: Germany

All search queries in the Innova database, main category ‘Food & Beverages’, were carried out within the associated 19 categories, with the exception of pet food.

In the GNPD Mintel database, the search was carried out in the main categories ‘Food’ and ‘Drink’ and, in addition, the sub-category ‘Vitamins & Dietary Supplements’ in 26 categories.

In order to be able to compare the search results, it was necessary to standardise the various categories of the databases. For this purpose, the 26 categories of the Mintel GNPD database were adapted to the 19 categories of the Innova database (see Table 1). The Mintel GNPD database does not include the ‘Sports Nutrition’ category. The foods sorted here in the Innova database can be found in Mintel GNPD in various categories and can, if necessary, be identified using appropriate filters and the term “Sports”.

Table 1: Bringing together the categories of both databases

Number of categories	Designations in Mintel	Designations in Innova
1	‘Alcoholic Beverages’	‘Alcoholic Beverages’
2	‘Baby Food’	‘Baby & Toddlers’
3	‘Bakery’	‘Bakery’
4	‘Breakfast Cereals’	‘Cereals’
5	‘Chocolate Confectionery’	‘Confectionery’
	‘Sugar & Gum Confectionery’	
6	‘Dairy’	‘Dairy’
7	‘Desserts & Ice Cream’	‘Desserts & Ice Cream’
8	‘Fruit & Vegetables’	‘Fruit & Vegetables’
9	‘Hot Beverages’	‘Hot Drinks’
10	‘Processed Fish, Meat & Egg Products’	‘Meat, Fish & Eggs’
11	‘Meals & Meal Centers’	‘Ready Meals & Side Dishes’
	‘Side Dishes’	
12	‘Sauces & Seasonings’	‘Sauces & Seasonings’
13	‘Snacks’	‘Snacks’
14	‘Carbonated Soft Drinks’	‘Soft Drinks’
	‘Juice Drinks’	
	‘Other Beverages’	

	'RTDs'	
	'Sports & Energy Drinks'	
	'Water'	
15	'Soup'	'Soup'
16	Not available	'Sports Nutrition'
17	'Savoury Spreads'	'Spreads'
	'Sweet Spreads'	
18	'Sweeteners & Sugar'	'Sugar & Sweeteners'
19	'Vitamins & Dietary Supplements'	'Supplements'

Overview of the common search strategy:

1. Research strategy level: Fructose-glucose syrup
 This search should find products that contain a mixture of fructose and glucose in the form of syrup. It should contain mainly fructose.
 Using the free text field, the product ingredients searched for were "*Fructose Glucose Syrup*" and "*High Fructose Corn Syrup*". Since the second search term also includes HFCS-42 with a 42 % fructose content, it cannot be ruled out that this search also lists products that contain less fructose than glucose.
2. Research strategy level: Glucose-fructose mixtures
 This search relates to products that contain glucose-fructose syrup/inverted sugar syrup, or partially-inverted sugar syrup or inverted sugar. In contrast to the first search, mixtures with a higher proportion of glucose should be recorded here (> 50 % glucose). The following terms were searched for at the ingredient level: "*Partially Inverted Candy Sugar Syrup*", "*Glucose Fructose Syrup*", "*Partially Inverted Brown Sugar Syrup*", "*Partially Inverted Sugar Syrup*", „*Invert Sugar*“, "*Invert Sugar Syrup*" or "*Invert Syrup*", "*Brown Invert Sugar Syrup*".
3. Research strategy level: Fructose
 The aim of this search was to identify products that have added fructose or fructose syrup on their list of ingredients. The following terms were searched for at the ingredient level: "*Fructose*", "*Fructose Syrup*", "*Caramelized Fructose*", "*Crystalline Fructose*".

Using this approach, it cannot be ruled out that some of the products will be counted in two or three of the searches if they contain several of the ingredients listed.

5 Results

In the following, all results are shown separately according to the respective databases.

5.1 Results from the Mintel GNPD database

For the period defined as relevant between the years 2005 to 2018, around 150,000 products are found in the main categories 'Food' and 'Drink' and in the sub-category 'Vitamins & Dietary Supplements'.

The search for fructose-glucose syrup and HFCS initially yields 229 results in Mintel GNPD according to the search strategy described above. This search will also find products that contain "*fructose, glucose syrup*" in their ingredients. Of the 229 hits, this corresponds to 43 results that are not taken into account in the following graphical representation and further evaluations. This reduces the number of hits in the Mintel GNPD database to 186 results, which in Figures 1 and 2 have been separated according to the use of the terms "HFCS" and "fructose-glucose syrup" on the packaging.

These are mainly found in the categories 'Bakery', 'Confectionery', 'Ready Meals & Side Dishes', 'Snacks', 'Desserts & Ice Cream', 'Dairy', 'Sauces & Seasonings' (in all of them more than ten foods with the desired ingredient per category). In addition, the categories 'Soft Drinks', 'Breakfast Cereals', 'Processed Fish, Meat & Egg Products', 'Spreads', 'Soup' and 'Hot Beverages' contained at least one of the search ingredients (in all of these categories less than ten foods per category with this ingredient).

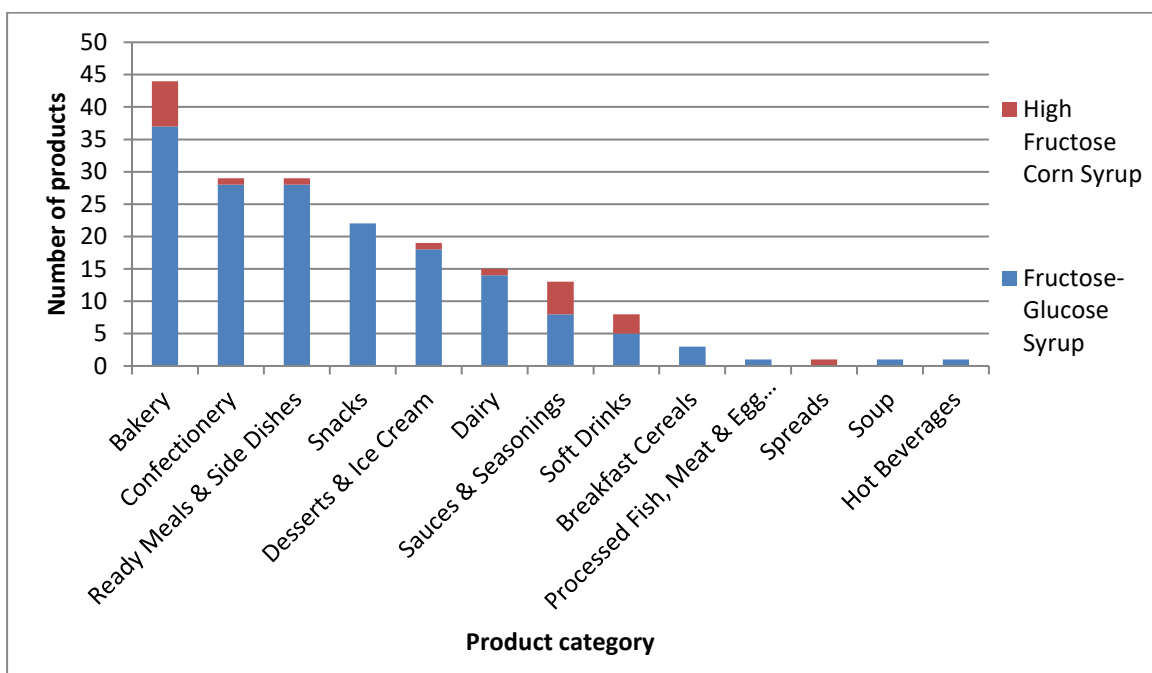


Figure 1: Number of products with fructose-glucose syrup or HFCS in Mintel GNPD broken down by category (search for Germany within the years from 2005 to 2018)

The chronological sequence shows a lower number of new product launches with the search ingredients in the years 2005 to 2012. For 2013 a peak (n = 32) stands out, and in the years 2014 to 2018 the values lie between 16 and 24 new product launches per year.

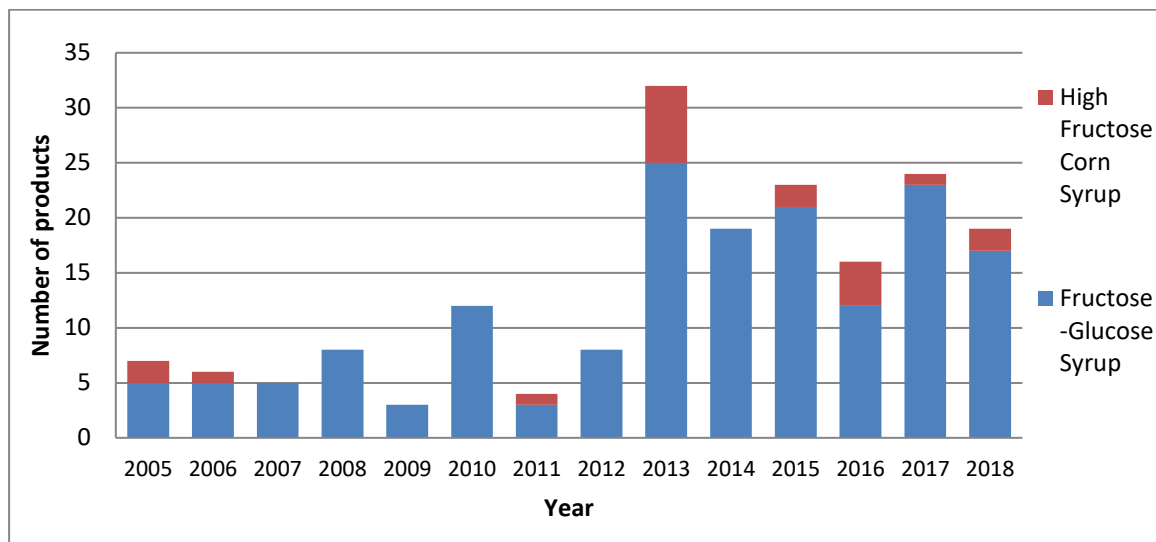


Figure 2: Number of products with fructose-glucose syrup or HFCS broken down by year of recording in Mintel GNPD (search for Germany within the years of 2005 to 2018)

The search for glucose-fructose syrup, inverted sugar and inverted sugar syrup yields 10,092 results in the GNPD Mintel database. Most of the results are found in the categories ‘Bakery’, ‘Confectionery’, ‘Desserts & Ice Cream’ and ‘Dairy’ (each with over 1,000 foods). In addition, there are 14 other categories of foods with at least one of the search ingredients (see Figure 3).

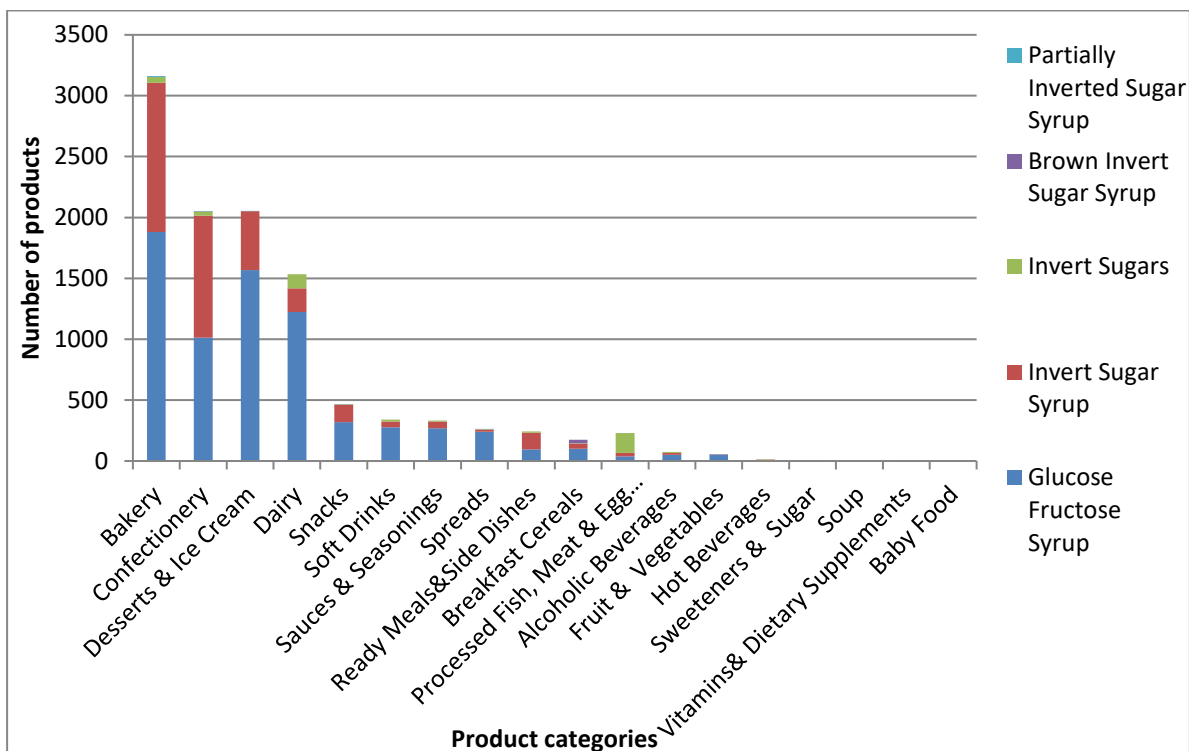


Figure 3: Number of products with glucose-fructose mixtures in Mintel GNPD broken down by category (search for Germany within years 2005 to 2018)

In the years 2005 to 2012, there was a steady increase in new product launches with the search ingredients. In the years 2012 to 2013, the number of new product launches almost doubled (see Fig. 4).

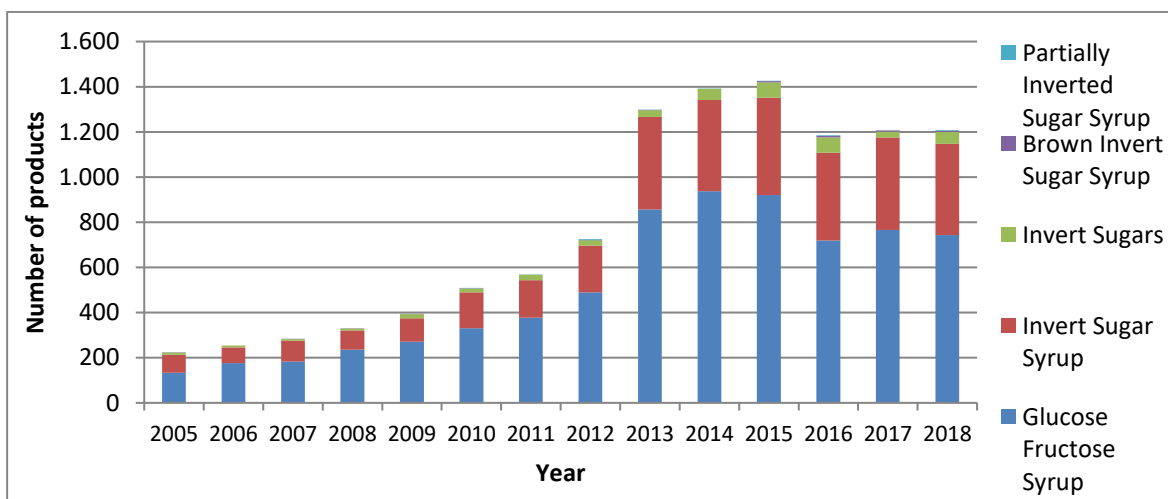


Figure 4: Number of products with glucose-fructose mixtures in Mintel GNPD broken down by year of recording (search for Germany within the years of 2005 to 2018)

The search for fructose and fructose syrup yielded 2,410 results. Most of the new product launches fall within the categories “Soft Drinks”, “Bakery”, “Confectionery”, “Snacks” and “Dairy” (each with over 200 foods). Foods containing the search ingredients were also found in 13 other categories (see Figure 5).

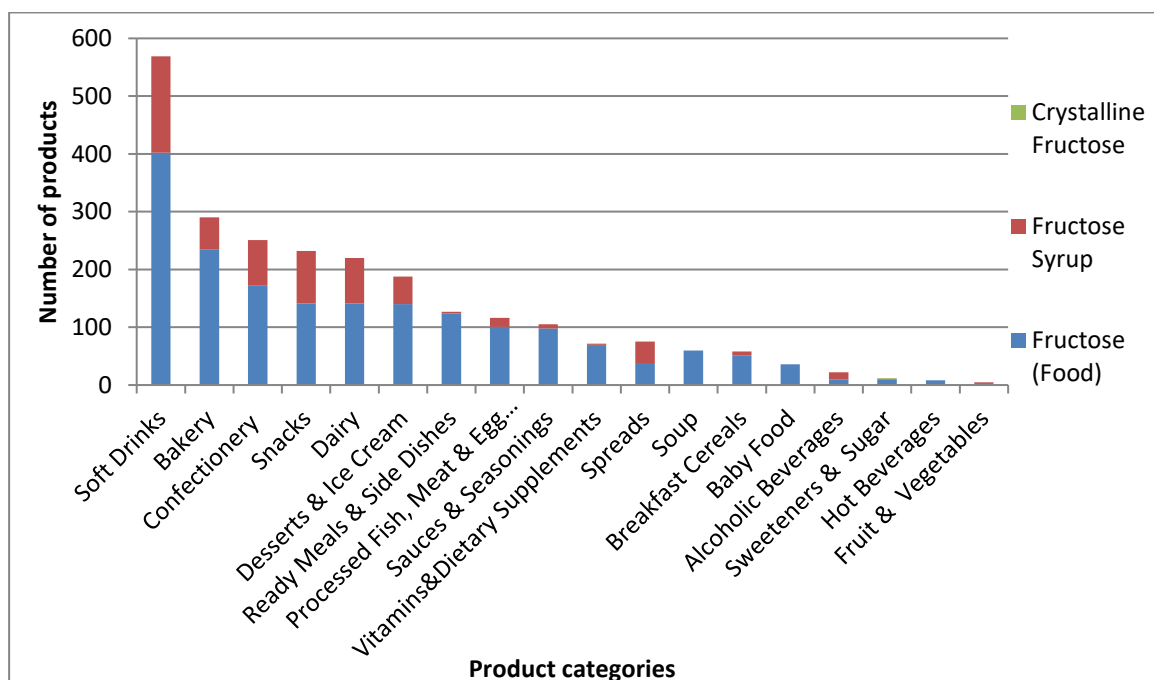


Figure 5: Number of products with fructose or fructose syrup in Mintel GNPD broken down by category (search for Germany within the years of 2005 to 2018)

An increase over time can also be seen here. From 2012 to 2013 there was a sharp increase. While in the years 2005 to 2012 the number of new product launches was less than 150, in the following years it increased by approx. 2/3 to values between 190 and 270 (see Fig. 6).

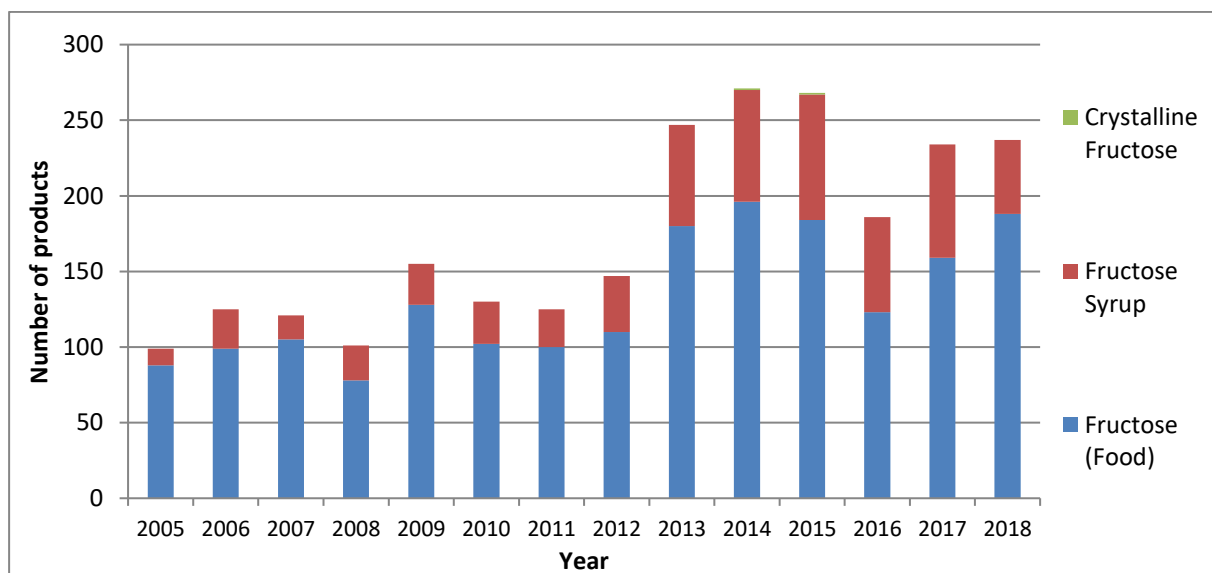


Figure 6: Number of products with fructose or fructose syrup in Mintel GNPD broken down by year of entry (search for Germany within the years of 2005 to 2018)

5.2 Results from the Innova database

The Innova database contains around 160,000 products in the main category 'Food & Beverage' for the 2005 to 2018 search period.

According to the research strategies described under Section 4, the search in Innova for products containing the ingredients fructose-glucose syrup and HFCS yields a total of 356 results. Of these, 209 results are for products with fructose-glucose syrup and 147 for products with HFCS in the list of ingredients, as shown subdivided in Figure 7.

In the search period mentioned, most of the new products with HFCS and fructose-glucose syrup can be found in the Innova category 'Confectionery' (n = 130), in which the majority of products contains HFCS (n = 85). In the category 'Sauces & Seasonings' also, more products were recorded with HFCS (n=21) than with fructose-glucose syrup (n=8). In contrast, no products with HFCS were recorded in the categories 'Snacks', 'Alcoholic Beverages', 'Meat, Fish & Eggs', and 'Spreads'.

In the other categories, e.g. 'Sports Nutrition', it's mainly products containing fructose-glucose syrup that were recorded. The only category that listed no new product launches with fructose-glucose syrup is 'Ready Meals & Side Dishes'.

Food categories that do not contain products with fructose-glucose syrup or HFCS are not shown in Figure 7. These are the categories: 'Baby & Toddlers', 'Fruit & Vegetables', 'Hot Drinks', 'Soup', 'Sugar & Sweeteners', 'Supplements'.

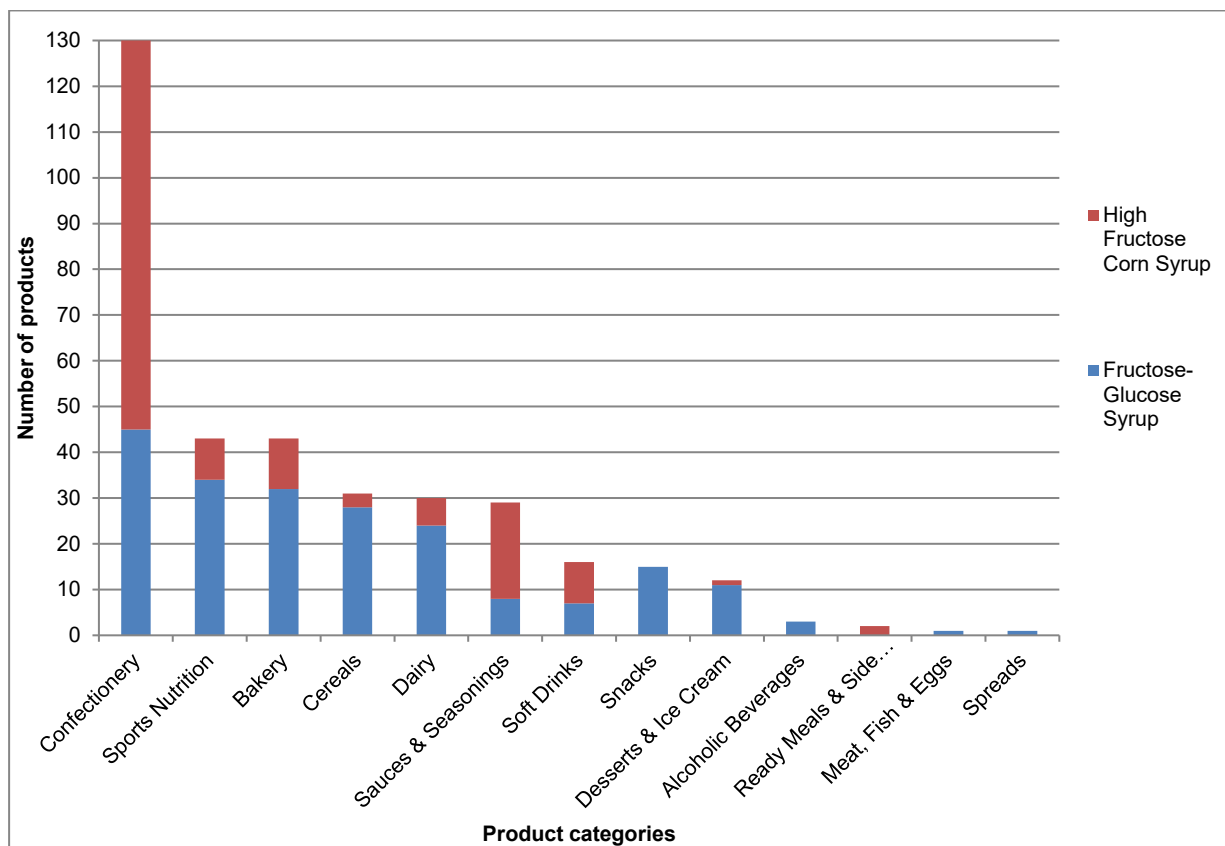


Figure 7: Number of products with fructose-glucose syrup or High Fructose Corn Syrup (HFCS) in Innova broken down by category (search for Germany within the years of 2005 to 2018)

Figure 8 shows the products with fructose-glucose syrup and with HFCS over time. In 2006 and 2007, new product releases with HFCS predominate, while in the years of 2009 and 2012 only very few new products containing HFCS were recorded. In 2018, no products with HFCS were recorded in Innova.

In 2009 and 2016, most new product launches were recorded with fructose-glucose syrup. In 2007, on the other hand, they accounted for the smallest share in the search period.

In 2014, the number of new product launches with HFCS and fructose-glucose syrup was almost equal.

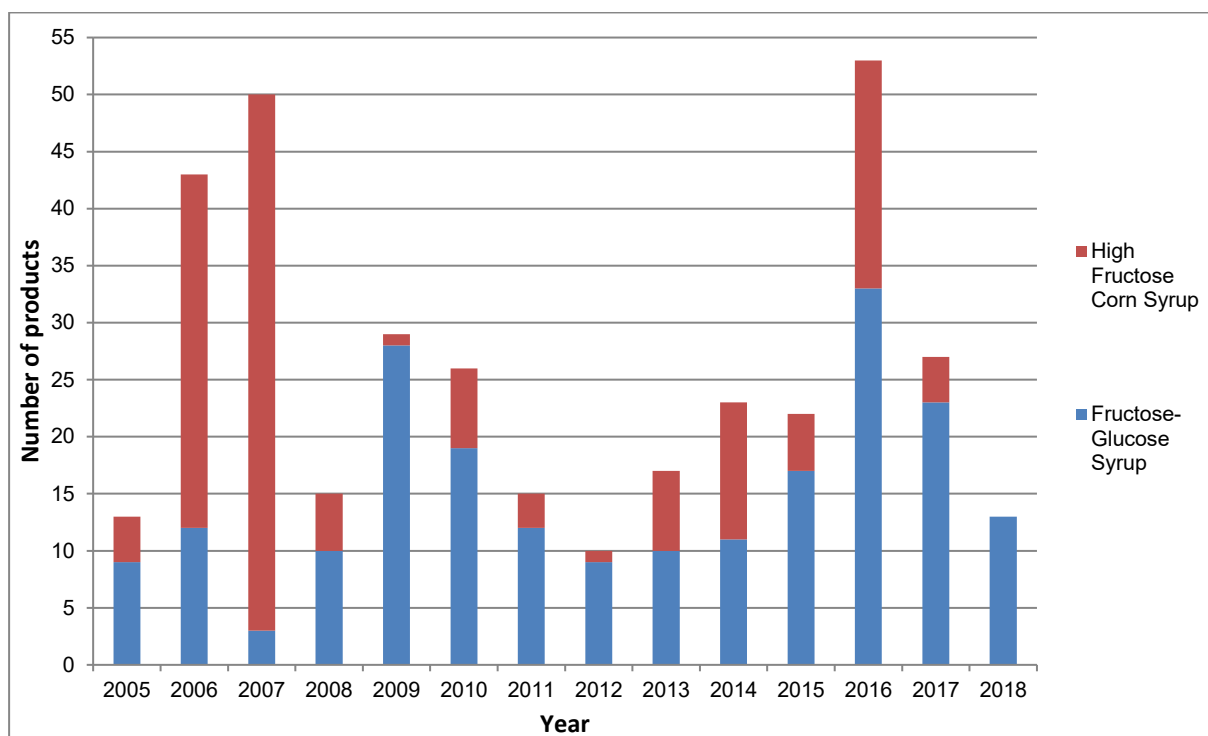


Figure 8: Number of products with fructose-glucose syrup or HFCS in Innova broken down by year of entry (search for Germany within the years of 2005 to 2018)

A search for glucose-fructose syrup, invert sugar and inverted sugar syrup yields 13,615 results in the Innova database.

The largest number of new products is listed in the Innova category 'Bakery' (n = 3,782), followed by the category 'Confectionery' (n = 3,363), as shown in Figure 9. In addition, the categories 'Desserts & Ice Cream' and 'Dairy' show a high number of new products containing the search ingredients.

A large number of products with the ingredient glucose-fructose syrup is contained in the categories 'Bakery', 'Desserts & Ice Cream', 'Dairy', and 'Confectionery'.

If the ingredients are considered separately, the largest number of products with invert sugar and inverted sugar syrup can be found in the categories 'Confectionery' and 'Bakery'. New product launches with the ingredient 'Brown Inverted Sugar Syrup' only include the 'Cereals' category. Products containing 'Partially Inverted Sugar Syrup' can only be found sporadically in the categories 'Bakery', 'Confectionery' and 'Cereals'.

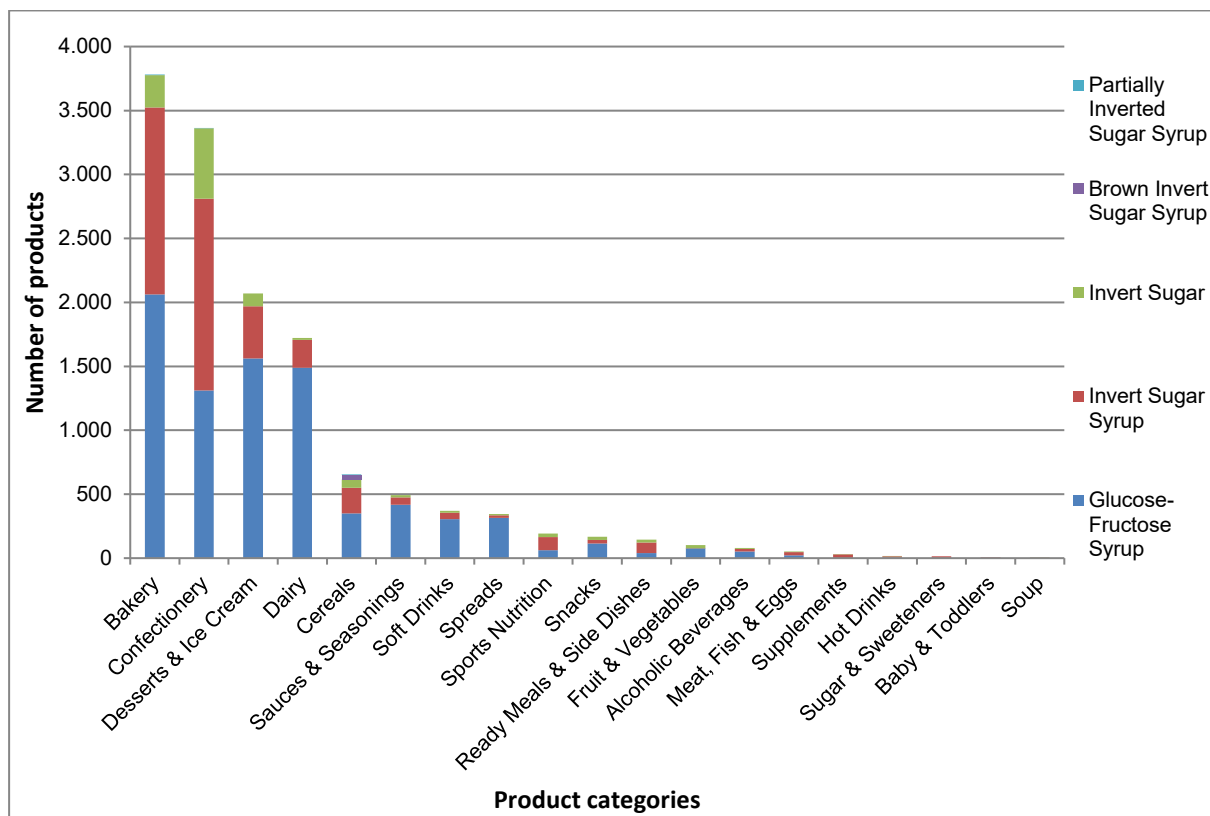


Figure 9: Number of products with glucose-fructose mixtures in Innova broken down by category (search for Germany within the years of 2005 to 2018)

In Figure 10, an increase in the number of newly launched products containing the search ingredients can be seen for the years of 2005 to 2010 and 2012 to 2016, respectively. The lowest number of products was recorded in 2011. After a peak in 2016, a decline in the number of newly recorded products is indicated from 2017 to 2018.

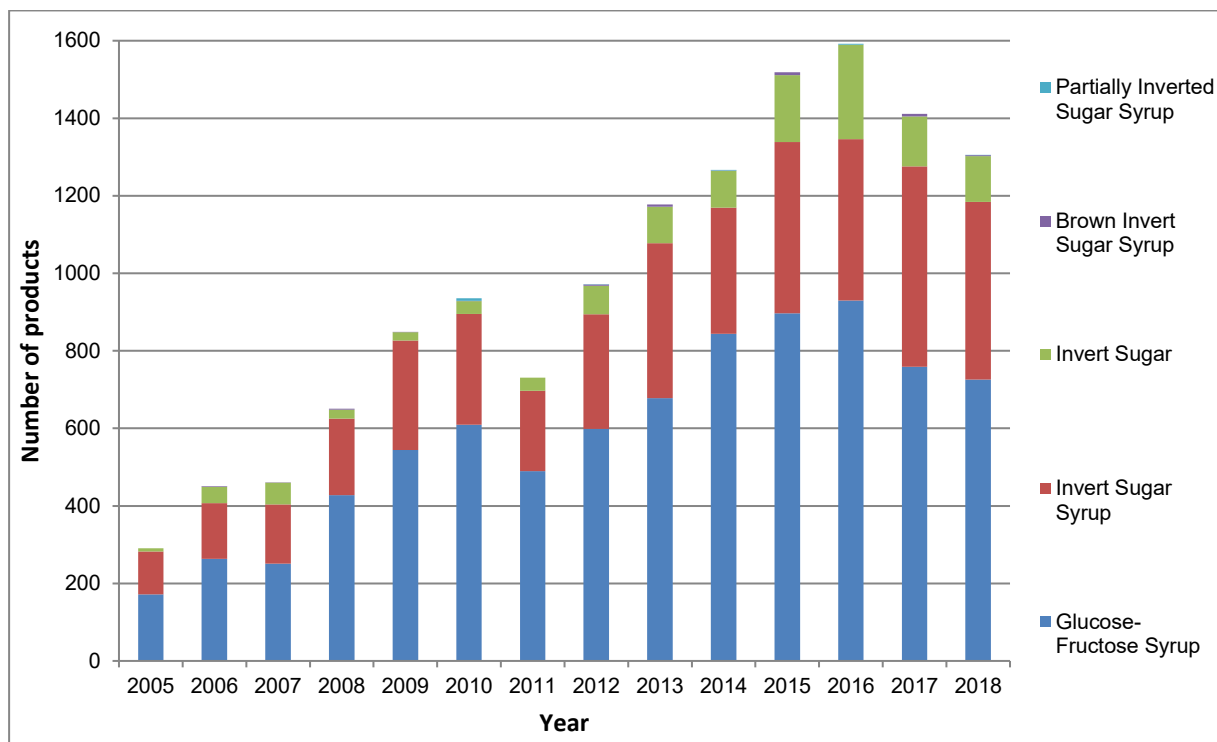


Figure 10: Number of products with glucose-fructose mixtures in Innova broken down by year of entry (search for Germany within the years of 2005 to 2018)

Researching fructose and fructose syrup yields 4,805 results.

As can be seen in Figure 11, most of the new products containing the search ingredients fall within the 'Sports Nutrition' category. This contains the largest number of products with the ingredient fructose (n = 3,642). A higher number of products with fructose can also be found in the categories 'Soft Drinks', 'Bakery', and 'Confectionery'. In general, the products in these categories contain more fructose than fructose syrup.

Products with the ingredient "Crystalline Fructose" can be found, other than in the category 'Sports Nutrition', only occasionally in 'Soft Drinks' or 'Snacks'.

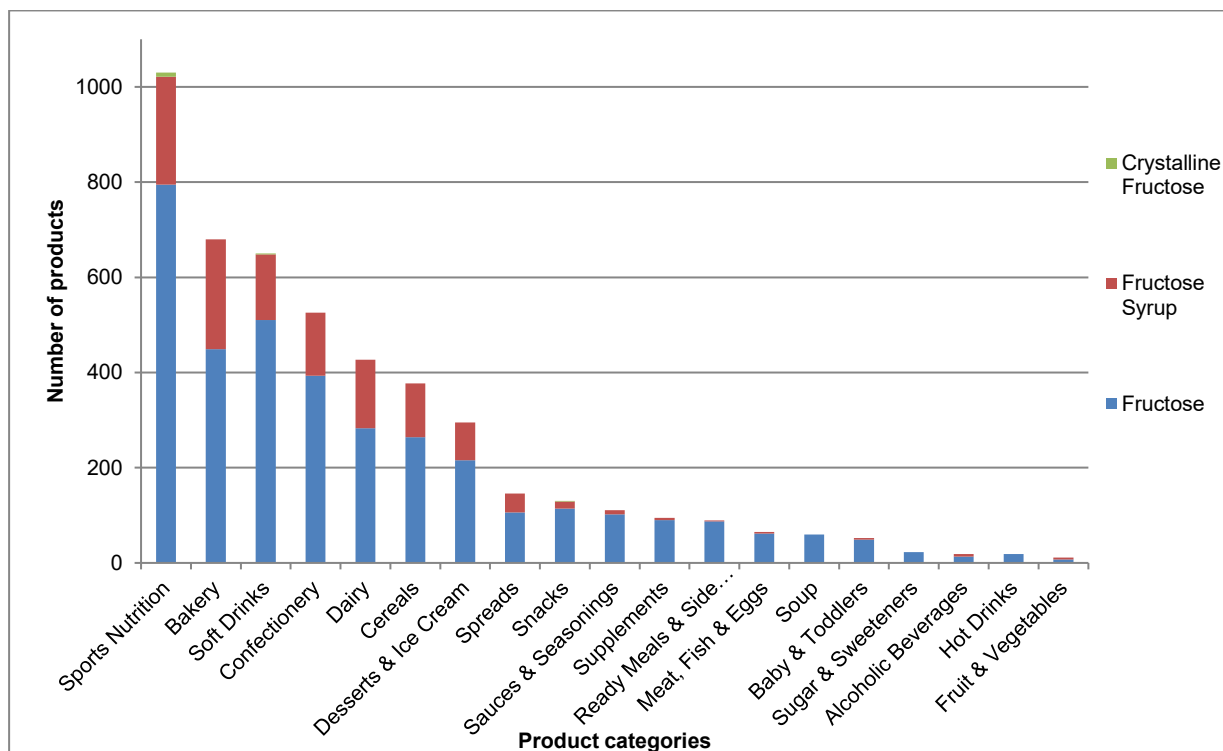


Figure 11: Number of products with fructose or fructose syrup broken down according to year of entry in Innova (request from Germany within the years of 2005 to 2018)

Figure 12 shows an increase in the number of new products containing the search ingredients from 2012 onwards (with the exception of 2014). Most new product launches are found for 2013.

2018 shows a significant decline in new products containing the search ingredients. Based on the entire search period from 2005 to 2018, the new products mainly contain fructose.

Products with the ingredient “Crystalline Fructose” were found in small numbers in the years of 2012 and 2016.

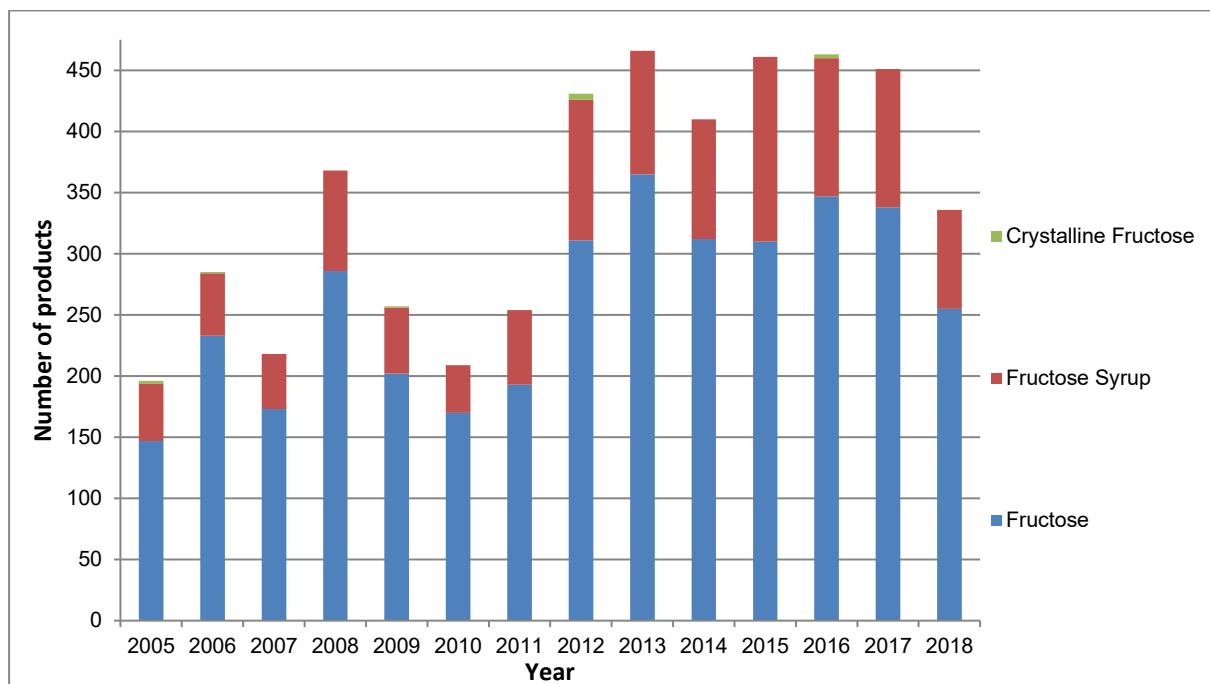


Figure 12: Number of products with fructose or fructose syrup broken down according to the year of entry in Innova (request from Germany within the years of 2005 to 2018)

6. Summary

In order to answer the question regarding the frequency of use of fructose-glucose syrup on the German market, the MRI evaluated the Innova database it has access to, and the BfR screened the Mintel GNPD database available there.

The result shows:

- The term “high-fructose corn syrup” (HFCS) is very rarely used in the contents of packaging in Germany. This also applies when the research is expanded to include the term “fructose-glucose syrup” (< 1 % of all products recorded for both Innova and Mintel GNPD).
- The most common use according to Innova is found in the food groups ‘Confectionery’, ‘Bakery’ or ‘Sports Nutrition’, ‘Cereals’, ‘Dairy’, and ‘Sauces & Seasonings’ proportionally related to all foods of the respective category of < 1 %.
- The most common use according to Mintel is in the food groups ‘Bakery’, ‘Confectionery’ or ‘Ready Meals & Side Dishes’, ‘Snacks’, ‘Desserts & Ice Cream’, and ‘Dairy’. Here, too, the proportion of products related to all recorded foods in the respective category is < 1 %.

The use of glucose-fructose syrup is much more common in Germany. Here the record numbers exceed those of fructose-glucose syrup by more than 40-fold. Both databases provide comparable results in this respect. The Innova database contains around 9,100 or 6 % more products than that from Mintel. The most striking difference is the number of products in the ‘Baby Food’ category, with about twice as many foods being recorded in Innova as compared to Mintel GNPD. The number of products found across all levels of the joint research strategy is higher with Innova than with Mintel GNPD. The reason for this could be that there are more products listed in the Innova database than in Mintel.

Further information on the subject of sugar from the BfR website

Communication on isoglucose and sucrose: <https://www.bfr.bund.de/cm/349/isoglucose-and-sucrose-household-sugar-can-be-assessed-similarly-in-terms-of-the-potential-to-damage-health.pdf>

Opinion on fructose: https://www.bfr.bund.de/cm/349/increased_intake_of_fructose_is_not_advisable_for_diabetics.pdf



BfR ‘Opinions app’

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About the MRI

The research of the Max Rubner Institute (MRI), Federal Research Institute for Nutrition and Food, focuses on consumer health protection within the nutrition and food sector. It advises the Federal Ministry of Food and Agriculture (BMEL) in these areas. Important research focuses include the nutritional and health value of food, nutritional behaviour and food safety and quality.

About the BfR

The German Federal Institute for Risk Assessment (BfR) is a scientifically independent institution within the portfolio of the Federal Ministry of Food and Agriculture (BMEL) in Germany. The BfR advises the Federal Government and the States ('Laender') on questions of food, chemical and product safety. The BfR conducts its own research on topics that are closely linked to its assessment tasks.

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