Liberté • Égalité • Fraternité
RÉPUBLIQUE FRANÇAISE

MINISTRY OF AGRICULTURE
AND FISHERIES

Directorate-General for Food
Subdirectorate for the Regulation, Research and Coordination of Controls

Report by the PNNS* task force on carbohydrates

Steps 1 and 2 of the commission

March 2007

SUMMARY

* (Programme Nationale Nutrition Santé – National Health Nutrition Programme)

Table of contents

1. Introduction

One of the goals inherent in the food policy implemented by the French Ministry of Agriculture[1] in association with ministries responsible for health and consumption is to incite the agricultural and agri-food industries to launch varied, high-quality foods that meet consumer expectations and public health objectives.

In fact, the National Health Nutrition Programme (PNNS) has set a number of public health objectives, some of which concern nutrients. One noteworthy objective concerning carbohydrates[2] is:

> *"To increase the consumption of carbohydrates such that they contribute to more than 50% of daily energy intakes by promoting the consumption of sources of starch, reducing current consumption of simple carbohydrates by 25%, and increasing fibre consumption by 50%".*

The PNNS steering committee assigned a task force, directed by the DG for Food (DGAL), under the Ministry of Agriculture and Fisheries, with establishing proposals in the context of a partnership approach with public and private-sector actors to increase carbohydrate intakes in our diet according to the following objectives: increasing complex carbohydrates (starchy foods) and fibres, reducing added simple carbohydrates.

Work commenced in September 2005 in the framework of the first National Health Nutrition Programme. It continued with the second programme (PNNS2) and helped define and schedule future actions in relation to the food supply.

In conjunction with the chairperson of the PNNS steering committee, the task force brought together representatives from:

- Administrations: the DG for Food, the DG for Economic, European and International Policy (DGPEI), the Ministry of Agriculture and Fisheries, the DG for Competition, Consumption and Fraud Control (DGCCRF) under the Ministry of the Economy, Finance and Industry, the DG for Health (DGS), and the DG for Social Action (DGAS) under the Ministry of Health,
- Different agri-food sectors, united under the banner of the French Association of Agri-food Industries, together with producers through the National Association Sugar Research and Documentation Centre (CEDUS),
- Distributors,
- Consumer associations,
- The French Agency for Food Safety (AFSSA),
- The National Institute for Prevention and Health Education (INPES),
- Research centres - Crédoc, the National Institute for Statistics and Economic Studies (INSEE), the National Institute for Health and Medical Research (INSERM), the National Institute for Agricultural Research (INRA), etc.,
- Other PNNS partners together with experts in specific fields (technologist, researcher on eating behaviour, etc.).

Through their presentations and exchanges, these members all helped complete the commission's first two steps, thereby laying the necessary foundation for future commitments:

- Step 1: establishing the current situation using the most recent data on the supply and on food consumption, and an appraisal of actions already carried out in parallel to the PNNS.

---

[1] The Ministry of Agriculture and Fisheries implements the food policy in collaboration with ministers responsible for consumption and health (Decree of 9 June 2005). PNNS2 confirms the role of the food policy implemented by the Ministry of Agriculture and Fisheries by encouraging those industries concerned to develop the nutritional quality of the food supply.

[2] **Note: prior definitions**

In this summary, as in the report, the definitions of carbohydrates are mostly those given in the AFSSA report "Carbohydrates and health: status, evaluation and recommendation" of October 2004, and will be specified when they differ. In particular, the concept of simple carbohydrates may correspond to a broader assumption including not only monosaccharides and disaccharides, but also other glucidic sweetening substances.

Simple carbohydrates: monosaccharides and disaccharides make up simple carbohydrates (e.g.: glucose, fructose, sucrose, lactose, etc.).

Added simple carbohydrates: addition of simple carbohydrates during the manufacturing or preparation of foods, as opposed to simple carbohydrates present naturally, such as lactose in milk, or fructose and sucrose in fruit and vegetables.

Complex carbohydrates: carbohydrates with a degree of polymerization (DP) greater than 2 (oligosaccharides and polysaccharides), as opposed to simple carbohydrates. For example: starch, cellulose, hemicellulose, pectins.

- Step 2: analysis of the costs/advantages and benefits/risks resulting from a modification in the supply with regard to consumers (behaviour, nutrient intakes, toxicological impact), producers and agri-food industries (technological constraints, sugar/starch economy).

2. Status and update of data

In order to assess the most recent data concerning the context, production data and consumption data, a number of studies or contributions to broader tools were created by or for the task force.

a) Economic data

Overview of carbohydrate-related themes

Firstly, in order to place the work carried out by other European countries on carbohydrates into context, the Ministry of Agriculture and Fisheries conducted a survey with agricultural attachés in the United Kingdom, Italy, Spain, Belgium, the Netherlands, Germany and Austria to ascertain the awareness of the competent authorities in this field (Ministries of Agriculture, Ministries of Health, Agencies, Research Institutes, etc.), as well as that of the agri-food industries. Various information was requested on how consumers and the media perceive the importance of nutritional quality, in particular concerning carbohydrates, how these aspects are taken into consideration, what public authorities plan to do, and the methods employed for getting agri-food industries or their corresponding associations involved in thought processes, as well as exemplary actions taken by companies either on their own or in partnership with technical research or socio-economic centres. Whilst all involved perceive nutrition as representing an important issue with regard to increased levels of obesity, joint actions by public authorities and agri-food industries with a view to deliberately orienting the food supply toward public health objectives, especially in terms of nutritional composition, are far from widespread, except in a couple of countries (Germany and the United Kingdom). The carbohydrates issue is not dealt with specifically, whereas the normative approach is sometimes envisaged (Sweden).

Assessment of public statistics and recommendations on collection

Next, with a view to monitoring developments in terms of the nutritional quality of products marketed, the task force needed to become familiar with the existing public statistical information system, and to evaluate any necessary improvements.
The Ministry of Agriculture and Fisheries carried out a study on the public statistical information system used in the agri-food industry, from production through to consumption and based on the example of carbohydrates, in order to better link the existing databases. The conclusions revealed that, whatever the method employed, existing data does not serve to ascertain the losses during processing cycles; the difficulty thus consists in specifically evaluating these losses. To track the processing of sweetening substances within the agri-food industries, a large, albeit insufficient number of investigations exists. Greater transparency concerning manufacturer recipes or their labelling would provide one solution for better tracing what becomes of basic agricultural products, bearing in mind that obtaining complete transparency from such a highly competitive sector, one in which manufacturing processes are known to be confidential, is no easy matter. Insofar as the sugar industries are concerned, sucrose is subject to supply appraisals, and conversion coefficients are needed to transform quantities of sugary foods into equivalent quantities of sucrose. Concerning direct sucrose production, data is forwarded by French sugar industrialists and subsequently collected, in particular by the Association of French Sugar Manufacturers (SNFS). For certain value-adding cycles, figures are only available concerning distribution; this is the case with fruit juices. For other cycles, figures are only available for consumption (in particular for soft drinks). The "apparent consumption" of the average French person comes in at approximately 35-36 kg/year/person (CEDUS, based on BIES, FIRS and INSEE sources). This gives an indication of availabilities on the domestic market that must be distinguished from individual consumption measured by investigations conducted by the AFSSA (INCA) and the CREDOC (CCAF): the actual consumption is less, in the region of 27 kg/year/person. Note that some of the sucrose outlets are non food-related (e.g., pharmaceuticals). Value-adding cycles of starch hydrolysis products, in particular "glucose syrups", are traditionally less well accounted for.

INSEE study

The task group contributed to an INSEE study entitled: "*Sugar products over the last 15 years: less sugar but more processed foods*"[3] (INSEE study no.1088, July 2006), with the following summary:
"Over the last 15 years, households have gradually increased the amount spent on sugar products, even though these products account for a smaller proportion of their overall food shopping. This shift can be explained by an increase in the consumption of processed foods. Household purchases now include more chocolate-based food and confectionery. The opposite applies for sugar (both in cube and standard form), where the downward trend can partly be traced to a fall in home baking. Purchases of sugar products in France as a proportion of household spending closely match the European average. Ireland and Spain consume the fewest sugar products, whilst the Baltic States and Poland top the list for sugar consumption. Sugar products accounted for just 36% of all simple carbohydrates in everyday diets in France in 2004, compared with 42% in 1990. Other products, such as soft drinks, cordials, fruit juice and nectars, which have seen significant development during this period, account for the remaining simple carbohydrates

Assessment concerning the supply of starch hydrolysis products

At the request of the European Statistical Office (Eurostat), the SCEES carried out supply assessments concerning most agro outputs. In the framework of the task force, an assessment of starch hydrolysis products was carried out based on this methodology for the period 1996 – 2004. The results reveal that, after an initial period of growth, the use of starch hydrolysis products by agri-food industries for human foods became stable as of 2000, at around 400,000 tonnes per year. Foreign trade of products that incorporate glucose only affect these results marginally.

b) Breakdown of the different types of carbohydrates in the food supply

By exchanging information among group members (agri-food sectors, AFSSA, Crédoc, INSEE), economic data pertaining to production and consumption has been effectively updated, thereby providing a common base on which to proceed.

Data concerning the intake of total and simple carbohydrates resulting from national surveys on individual consumption is well documented and globally consistent. However, it has not been possible to evaluate intakes of added simple carbohydrates, or to estimate the breakdown of the different types of simple carbohydrates in view of the current absence of objectivized data on added simple carbohydrate content in foods.

Exchanges between the AFSSA (French Agency for Food Safety) and PASER (State Strategic Action Projects at Regional level) on the one hand, and the food industries on the other hand have served to update the food composition database created by the CIQUAL (Informatics Centre for Food Quality), in particular in the perspective of the INCA2 investigation. With a new base list that includes products currently available on the market and data on the composition of the various categories defined, the updated CIQUAL database is scheduled to go online in early 2007.

In addition, presentations by sectors concerned have provided a certain amount of important information regarding carbohydrate and fibre content, although these are not homogeneous. They are summarized in Annex 2.

c) Contribution of the various food categories to carbohydrate and energy intakes

As early as 1994, a French survey on individual food consumption was conducted by the ASPCC (Sugar and sweet products association, communication, consumption), which was followed up by the study of carbohydrate consumption via INCA (1999) and CREDOC – CCAF surveys. The CREDOC made a specific analysis of the CCAF 2003 survey for the task force. Taking into account methodological bias, a comparison of the ASPCC-1994, INCA 1999 and CCAF 2003 surveys gives the following conclusions (see Annex 3):

[3] Note that figures account for standard products and "light" or "sugar-free" products. The study does not distinguish the development of "light" or "sugar-free" products compared with standard products, except for drinks and table sweetening agents.

- The **contribution of total carbohydrates** to energy intakes seems to be on the increase, counterbalanced by a drop in the contribution of lipids, both in children and in adults.
- Complex carbohydrate intakes (in g/day) are on the increase, while simple carbohydrate intakes are stable, or decreasing for adults. It is likely that **simple carbohydrate consumptions levelled out** between the readings from the INCA survey and those of the CCAF survey, having increased between the ASPCC survey and the INCA survey, and that the current upward trend observed for total carbohydrates ties in with increased complex carbohydrate intakes. Note that here, the term "simple carbohydrates" corresponds to all mono and disaccharides contained in foods, either naturally present or added for their technological role (mostly sucrose, glucose, fructose, lactose, galactose and maltose).

Use of the CREDOC – CCAF survey for the ASPCC establishes a list of 34 foods that carry carbohydrates. The contributions in total, simple and complex carbohydrates have been detailed for adults and children as a grammes/day percentage, and in relation to energy intakes (see Annex 4).

The type of breakdown (children/adults, age group) and the unit selected to establish the classification infer considerable variations in the hierarchy of carbohydrate carriers.

d) Consumer typology elements

According to the CCAF-CREDOC 2003 survey:

- **Simple carbohydrate intakes (in g/d) are higher among males, both for children and adults**. There is no difference between boys and girls in terms of simple carbohydrate contributions to energy intakes without alcohol (%EIWA). This is not the case with adults, where the proportion of simple carbohydrates in energy intakes is significantly higher among women.
- **The trend for simple carbohydrate intakes according to age shows an increase in the amounts consumed up until adolescence, with a break for young adults, and a drop with age**.
- **The contribution of simple carbohydrates to energy intakes increases significantly along with the level of education** (the same trend is observed in terms of socio-professional category and household revenue among children and adults alike). Even if for children, absolute intakes of simple carbohydrates (in g/d) only vary slightly according to the family head's level of education, the respective proportions of simple carbohydrates for energy intakes and simple carbohydrates for all carbohydrates are significantly higher for children from the best educated households.
- **The "most sedentary" children (more than 2 h/day in front of a screen) have intakes of total carbohydrates (TC), complex carbohydrates (CC) and simple carbohydrates (SC) that are higher than the "least sedentary" group (less than 2 h/day in front of a screen).** This trend is repeated among adult males: higher intakes of SCs and TCs for the "most sedentary". However, for the "most active" (who claim to pursue a physical or sporting activity for more than 2 h/day), intakes of TCs and CCs are higher. Among women, there is no significant difference.
- **The group comprising the biggest consumers of simple carbohydrates** (3rd tercile) has the highest energy intake (in kcal/day), the highest intake of all types of carbohydrates (in g/day), and the highest intake of lipids and protids. Contributions by carbohydrates and simple carbohydrates to energy intakes without alcohol (% EIWA) are also highest in this group, whereas, conversely, contributions by lipids and protids are lowest. This group also contains the lowest proportion of individuals below 2/3 of the recommended nutrient intake for certain micronutrients in children and adults alike, explained by dietary intakes that are quantitatively higher.

More specifically, concerning "light" products, the Crédoc[4] survey "La santé par l'alimentation" (Healthy eating), undertaken by the DGAL in 2006, demonstrated that "light" products are consumed "*because they are good for your health"* and "*to avoid gaining weight, or to lose weight"*. The majority of regular "light" product consumers are also regular "low-fat" product consumers. Moreover, **11% of those surveyed admitted to consuming a larger quantity of foods when light**. The consumption of "light" products is **more prevalent among women, the better educated, 2-person households, salaried employees, high earners, people on a diet, those with a high body mass index (BMI),**

[4] Undertaken by the DGAL, the "Healthy eating" survey was conducted between December 2005 and January 2006 with 200 general practitioners on the one hand, and 1704 individuals representing the general population aged 18 and over on the other hand. The sample's national representativeness is guaranteed by quota sampling (size of agglomeration and area of residence for the practitioners; age, sex, individual profession and socio-professional category, size of agglomeration and area of residence for the individuals). The surveys were conducted by telephone.

the least active, those who often follow the advice of doctors (general practitioner or otherwise), those who eat the most fruit and vegetables, vegetarians, those most concerned by their appearance and their health, and those most innovative in terms of diet. **Younger people represent a significantly higher proportion of "light" product consumers,** irrespective of confectionery and chewing gum consumers[5].

These results reflect the conclusions of the CCAF survey on simple carbohydrates: women eat less in terms of quantity than men, but have a diet richer in simple carbohydrates. Similarly, **the contribution by simple carbohydrates to energy intakes increases significantly with level of education, socio-professional category and household income, both among adults and children**.

e) Appraisal of food sector actions, and monitoring of the supply

An appraisal of the actions taken by each sector has been established, a summary of which is given in the table in Annex 5.

The following can be noted in particular:

Concerning compotes, the development of products with lower sugar content and using new denominations has brought about a drop in total sugars from 24% to 17% on virtually all products: for "fruit purées" with no sugars added (for which the market share progressed from 4% to 12% between 2003 and 2006), for "fruit desserts", and for "light compotes". This trend went hand in hand with smaller individual portions equivalent to one serving of fruit (small dishes and bottles/flasks = 81% of the market) together with a diversification of the offer (mixture of different types of fruit to attract new customers).

Concerning fresh dairy products, in 2005 "sugar-free" products represented 40% of the total supply, with "no sugars added" products accounting for 32.4%, and "sugar substituted" or "sweetened" products for 7.4% of the market.

Concerning soft drinks, in 2006 sugar-free drinks with intense sweeteners represented 20% of the market. Meanwhile, drinks with reduced sugars and no sweeteners (i.e. less sweet taste) now represent 8% of the market, and drinks with reduced sugars but with sweeteners (to maintain a sweet taste) represent 2.3% of the market.

Concerning confectionery, the supply of "sugar-free" products has increased considerably over the last 10 years, and now represents 91% of the market for chewing-gum, and 60% for traditional confectionery.

Concerning breakfast cereals, for the past two years all manufacturers have reduced their products' sugar content, in particular the 3 leading brands (representing 85% of the market), either via new products with 9 to 25% less sugars, or by reformulating existing recipes using whole cereals for at least 20% of the product, and 4 to 10% less sugars.

Concerning institutional and commercial catering organizations, presentations by the GECO and by McDonald's have revealed increased company awareness, with the undertaking of noteworthy initiatives as a result of the successful mobilization of the leading players. However, rules specific to the public market create certain difficulties (smaller markets require global orders), and purchasers are not usually trained on nutritional matters.

Specific exchanges have been organized to lay the foundation for a study directed by the AFSSA with a view to monitoring food supply developments in terms of carbohydrates. Different product categories have been selected[6], inside which analyses by sampling will be carried out to measure changes in simple and complex carbohydrate levels and fibre levels, or for which data will be collected when it

[5] Whether or not they are "standard" or "sugar-free". In fact, 60% of confectionery is now sugar-free; this figure reaches 91% for chewing gum.

[6] Juice and nectars, soft drinks, yoghurts and fermented milk, "ultra-fresh milk" drinking yoghurts, biscuits, breakfast cereals, cream desserts, rice pudding, etc.; despite their important contribution, cakes and pastries will not be included in the analyses given the sector's excessive diversity, in particular concerning small-scale producers.

already exists. The carbohydrate components to analyse have been subject to an AFSSA notification (notification no. 2006-SA-0140). This study will make it possible:

- To track changes in carbohydrate intakes: via average composition data representative of food consumed in France (based on market shares) over at least two periods of time.
- To estimate carbohydrate composition changes in the product supply: via specific sampling, representing an "innovative pool" to track changes in composition for innovative products (that may otherwise not be considered in the first case since they do not represent a sufficiently large market share).

The purpose of the study is also to establish a historical appraisal accounting for changes implemented between 2000 and 2006 based on company data. The task of collecting data from associations and companies will thus continue to this effect, both to enhance this AFSSA study on carbohydrates, and also more generally to encompass all nutritional characteristics with a view to establishing a food quality monitoring centre. Currently being investigated, this centre's purpose will be to track changes - especially nutritional – in the quality of food products introduced on the market.

3. Comparison analysis of benefits and risks concerning the optimization of nutritional composition

a) Behavioural impact

INRA researchers auditioned have provided elements concerning the behavioural impact of modifications to the nutritional composition of food products:

- Humans' liking for sugar is very widely shared. While sugar undoubtedly gives food and drink a pleasant flavour, preferences for sugar vary considerably from one individual to another. Furthermore, sugar stimulates food consumption, especially among children and the elderly.
- Various investigations have served to monitor consumption behaviour after the ingestion of sweeteners. These investigations have shown the existence of a phenomena whereby individuals compensate for missing calories, but not systematically since it ties in with such factors as age, sex, duration of the food intake, type of food ingested, and so on. Young people tend to compensate fairly well, whereas women on the whole try to control their intake, and will stop themselves from compensating. Nevertheless, when individuals do compensate, it is often approximate, with a slight gain remaining in the balance.
- Concerning complex carbohydrates and fibre, consumer tastes differ. How well one category accepts the taste and texture of bread that is rich in fibre contrasts sharply with another.

In addition, representatives of the various food sectors have referred to different elements.

Acceptability studies are complex to set up, and are carried out for complete reformulations rather than gradual modifications. One account (from a biscuit manufacturer) reveals that a 10% reduction in sweet taste compared with a standard recipe is highly significant, and implies substantial adjustments to the formula (cocoa bitterness, fruit acidity, etc.) to make up for the loss in acceptability. Research therefore not only focuses on sweet taste, but compares marketable products. Acceptability tests on breakfast cereals revealed a rejection by consumers when sugar content was reduced by 33%, or by 15% for corn puff cereals.

According to the Crédoc survey, for products with reduced sugar content, 11% of those polled claim to consume more when the product is "light".

The presence of sweetening agents in a product and the regulatory notice on the side effects of polyols may sometimes represent a psychological braking factor for certain consumers.

According to a survey with manufacturers of fresh dairy products conducted by Syndifrais, the rejection rate by consumers for products with a lower sugar content is appreciable, resulting in a withdrawal of 23% of product references from the market (bearing in mind that no mention of any reduction was made for 59% of references).

In France, consumers tend to shy away from products rich in fibre (with the exception of the whole-grain bread market, for example). Indeed, these products are often associated with "health food", and

consumers are not accustomed to their taste and appearance. For example, whole-wheat pasta is not particularly appealing to the consumer since it is darker, harsher and more astringent. Opening up regulations in favour of other ingredients would be useful to make up for such sensory deficiencies. Promotion and information in the direction of the user remain essential for this type of product.

b) Technological aspects

Concerning the reduction of simple carbohydrate levels

In the context of its extensive involvement with the various sectors concerned, Alliance 7 summarized all the technological functions of sucrose and other sweetening substances (glucose syrup, glucose-fructose syrup, glucose, inverted sugar, lactose, fructose, honey, fruit concentrate, fruit preparations, etc.) in the diagram below:

DIFFERENT PROPERTIES

"Process"	"Product"
Texture Medium for fermentation Structure Preserving	Nutrition: "Energy" Preserving
Sweetening substances	
"Aspect"	"Taste"
Crystallization Shiny/smooth Brown colouring Powdering Viscosity/solubility	Flavour/Flavour enhancer/balance Consistency Caramelization and production of aromas

The various presentations given by the sectors' representatives have effectively clarified the particularly important roles of sugar, depending on the corresponding food category.

For soft and crusty bread products, sucrose, present in very low quantities, plays a role in the all-important fermentation process. Given the density of biscuits and cakes, any reduction in sugars must necessarily be compensated for by other ingredients. Modifying the composition of biscuits implies considerable changes to their rheological properties, and presupposes additionally modifying the process: this generally results in a very different product. Chocolate is also a very dense food for which any substitution must be of equal mass. If the sugar content is reduced without replacing it with other ingredients, the proportion of cocoa increases and, therefore, its energy value. Substitutions can be made using polyols, dietary fibres or intense sweeteners to counterbalance bitterness. The role of ydrates in confectionery (mostly sucrose or glucose syrup) is predominantly functional, and represents the product's actual base. Consequently, any reduction in carbohydrates necessarily implies substances with bulking and sweetening properties. Moreover, some confectionery products are defined in a code of practice. In breakfast cereals, sweetness is an important element that conditions whether or not they are accepted by consumers. Here, in fact, sweetening agents are forbidden.

The analyses concerning the technological constraints involved in reducing simple carbohydrates carried out in each Alliance 7 sector highlighted room for manoeuvre in terms of optimizing the sugar content of products:

WHICH SUBSTITUTES FOR SIMPLE CARBOHYDRATES?

	Breadmaking	Biscuits	Cereals	Chocolate	Confectionery
Density (air, water)					
Flour					
Fibres					
Malto dextrins					
Glucose syrup					
Polyols, sweetening agents					

…while reconciling: **Nutrition**
Sensory qualities
Industrial feasibility and costs

For fresh dairy products, sugar has three main technological roles:
- fermentation substrate
- organoleptic role
- texturing role

For drinks, sugar is an agent for sapidity (taste and flavour associated with acidulants and aromas) and texture. It can either be replaced by intense sweeteners, or not replaced at all, corresponding to two different types of drinks depending on the taste sought by the consumer.

In compotes and canned foods, the role of sugar is mainly organoleptic, especially for the most acidic fruits, although it can also play on texture. In this sector, replacing sugar is recommended when possible, but without substituting it by less desirable components.

In jams, sugar:
- is a traditional element for preserving fruit by reducing water activity and protecting against the activity of unwanted germs
- is a texture agent, in particular by favouring gelling
- contributes to taste

For ice creams, sucrose can be partly replaced by glucose syrups, however, any substitution that produces a sweet solid with a maximum 5% of glucose creates problems in terms of viscosity that do not allow certain substances to work properly, thereby hindering the desired quality.

Concerning an increase in complex carbohydrate and fibre content

The production of whole-wheat pasta requires manufacturers to adapt their equipment and processes. Production costs are therefore higher due to such matters as industrial organization, product flow, productivity, technological difficulties, availability of source materials, etc.

Concerning bread, the production of flour type 80 leads to disruptions in the milling process. Heterogeneous grain sizes can pose problems in terms of delivered product homogeneity. For the actual bread production, there are a number of minor technical difficulties inherent in "controlled rising". These problems can be overcome, but presuppose additional costs and requirements in terms of research and development.

Conclusions on the technological aspects

Modifying carbohydrate and/or fibre content affects the process and can have a significant impact on the characteristics of the products concerned. For products used in traditional recipes, or codes of practice, solutions other than modifying the nutritional composition will need to be considered.

Two options appear possible depending on the situation:
- Reformulating the product's carbohydrate and fibre content slightly and very gradually over a long period of time so as not to change the nature of the product.

- Creating a completely new product with significant reduction or enrichment rates, thereby justifying the presence of simple carbohydrates or fibres.

In any case, it must be emphasized that the R&D changes involved can be costly, and may entail risks when it comes to releasing new products on the market if not appreciated by the consumer.

c) Nutritional impact: substitution and impact on intakes

Data from the agri-food sectors

The elements provided by these sectors have shown that modifications in the nutritional composition of their food products do not always – or to a limited extent – imply a lower calorie intake. For example, "low carb" chocolate or "with no sugars added" automatically infers an increase in cocoa content and, therefore, in fat. The result is a higher calorific value. For soft and crusty bread products, sucrose can be substituted by sweeteners (e.g., glucose syrup, dextrose) since this substitution maintains fermentation possibilities, however it is of no nutritional value since the product's content in carbohydrates and calories remains the same. For biscuits and cakes, there would be little point – from a nutritional perspective – in replacing sugar with other sweeteners. Starch, fibres or polyols represent possible substitution solutions to be considered, even if they would lead to products that are ultimately very different and more costly.

For fresh dairy products, reducing the amount of sugar without replacing it by another bulking agent automatically means higher white solid content (lipids, proteins, lactose), which is of no real nutritional value given the slight reduction in energy value (the survey undertaken by Syndifrais with certain manufacturers revealed a limited reduction in the energy value, at 5.9%). The use of sweetening agents can only be envisaged on "light" ranges, as is the case at present, given regulatory constraints and consumer demand.

However, insofar as carbohydrates are concerned, the PNNS programme is all about balancing intakes, not reducing calorie intake. One possible approach is to proceed gradually, especially since the final impact depends on all the actions taken on all levels. By way of example, actions on the food supply are not limited merely to composition; they also concern communication, advertising, size of portions, to name but three. Moreover, the PNNS also seeks to change eating behaviour.

Simulating changes in nutritional intakes as a result of modified compositions

To find out the impact of modifications to nutritional composition on intakes, hypothetical modifications have been formulated (low, average and high) corresponding to ranges which sectors may adopt in the future for reduced levels of simple carbohydrates (sweet dairy products, soft drinks, viennoiseries, biscuits, cakes and pastries, chocolate, confectionery, breakfast cereals, jams, compotes), and increased levels of fibre (crusty bread, soft bread).

On this basis, the AFSSA carried out a prospective simulation (2006-2011) (see Annex 6) to evaluate the impact of a modification to the carbohydrate profiles of different food categories on daily carbohydrate intakes from all carbohydrate-carrier foods (simulation of intakes in terms of simple carbohydrates, complex carbohydrates and fibres, defined according to regulations).

The consumption data from the INCA study was used to give weight to the variability of eating habits among individuals (adults and children), according to intake distributions (median, average, quartiles and 90th percentile).

Two limits inherent in this simulation must already be observed:
- It is done in relation to constant consumption, without reflecting the impact of other actions taken (reducing the size of portions, education on nutrition, etc.).
- It reflects hypotheses likely to be higher, all the more so given that a positive effect will occur.

Lower concentrations of simple carbohydrates and increased consumption of food and drink with no sugars added, or low in sugars, would lead to a drop in simple carbohydrate intakes of 1.2g/day on average, according to the central hypothesis. For the biggest consumers of simple carbohydrates (90th percentile), the absolute reduction is more marked: 2.5g/day. The drop in simple carbohydrate

intakes for children would be 1.9g/day on average, according to the central hypothesis. For the biggest consumers of simple carbohydrates (90th percentile), the drop in simple carbohydrate intakes would be 3.1g/day. The reduction in intakes is more marked among children because of a greater contribution to lower simple carbohydrates intakes from breakfast cereals, biscuits and soft drinks than for adults.

Fibre intakes would increase slightly, almost entirely as a result of modified bread compositions, going up from 17 to 17.3g/day for adults, with gains that are even more limited for children.

By taking into account information provided by professionals on the substitution of macronutrients whose content is reduced, we can estimate the change in intakes of energy, and of proteins, lipids and total carbohydrates. For adults, as for children, a drop in energy intakes of approximately 7kcal per day is observed according to the central hypothesis. This reduction in energy intake concerns carbohydrates, and is not compensated for by other macronutrients. Indeed, lipid and protein intakes remain stable.

Nutritional consequences of substitutions

Following on from AFSSA notification no. 2006-SA-0140, work by experts has more clearly identified the nutritional consequences of types of substitution for sucrose (see Annex 7), both positive and negative.

d) Toxicological impact

Insofar as the toxicological impact is concerned, legislation regarding sweeteners guarantees their harmlessness by means of their evaluation and through the definition of an ADI that represents a safe level of consumption rather than a toxicity threshold. If statistics were to indicate that the ADI were regularly exceeded by certain segments of the population, the Commission would look into revising the amounts present in food products, or else reduce the range of products in which the additive is authorized.

e) Economic impact on the sugar and starch industries

The DG for Economic, European and International Policy (DGPEI), under the Ministry of Agriculture and Fisheries, undertook an assessment of the economic impact on the sugar and starch industries.

In the "high" variant for the reduction of added simple carbohydrates (-10%), a drop in demand by French agri-food industries would represent 39 kilotonnes (kT) of starch hydrolysis products, and 222kT of white sugar, which, in terms of agricultural source materials, would correspond to 70kT of cereals, 145kT of sugarcane and 1500kT of beet.

Applied to France, the impact in volume would be markedly higher on the production of sugar plants than on grain farming. By integrating the foreseeable effects of reform by the OCM Sugar regime and the Biofuel Plan, an 8% reduction commitment would lead to beet production dropping below 2003-2004 levels.

According to certain hypotheses, a simulation carried out with the Farm Accountancy Data Network (FADN) shows that, regarding a "base scenario" by the horizon 2010 integrating CAP reforms (Luxembourg compromise, OCM Sugar regime) and the Biofuel Plan, the disposable income of beet growers would drop by €318 (-0.7%) in the "high" variant for the reduction of added simple carbohydrates.

One uncertainty remains regarding the impact of commitments on the processing sector. Against a backdrop of widening limitations applied to subsidized exports to third countries, there will no doubt be limited room for manoeuvre by the sugar and starch industries to export surplus stock.

Nevertheless, the assessment's results must be interpreted with all due caution given the high assumptions set down. Thus, the Association of French Sugar Manufacturers (SNFS) and the Federation of Sugar Beet Growers (CGB) consider the sugar industry's situation in March 2007 alarming, with stocks representing the equivalent of one year's consumption. According to the SNFS,

any detriment, no matter how slight, to France's sugar market would have very serious consequences in today's strained situation.

f) Conclusions

Two approaches are possible and already underway to improve nutritional quality:

– A significant modification to the composition, thereby allowing for the corresponding claim. In fact, this approach considerably alters the product, which is often subsequently positioned in a more specific market segment (light products, health food), and does not always appeal to the masses.

– A gradual modification using smaller reduction rates and without changing the nature of the product, thereby maintaining consumer acceptability and avoiding the switch to less appealing product categories. The product will not benefit from any claim in this respect, however both the manufacturer and the sector itself may benefit from a form of institutional communication on the approach adopted.

A third approach is worth considering for reducing added simple carbohydrates, and would be complementary to the previous two: that of an appreciable reduction, but below 30%. While the product could not subsequently claim to be "low in", it could, regulations permitting, benefit from a comparative-type claim: "contains x% less sugars". This information would be useful for the consumer since it is not misleading, and given that the actual reduction is significant.

In addition, it would be worthwhile looking at changes in the size of portions to avoid possible consequences in terms of price increases and greater demand with the offer's quantitative diversification. Similarly, global consideration must be given to advertising.

4. Courses of action by sector

Following on from the analysis, the sectors concerned identified the following courses of action, grouped into three main categories:

o <u>Actions on the products:</u>
  - Optimization of the nutritional composition (by gradually reformulating, or through new products) and development of the corresponding markets
  - Size of portions
  - Nutritional labelling and recommendations

o <u>Actions in relation to consumers:</u>
  - Communication campaigns
  - Advertising, promotion

o <u>Partnerships, data exchange and development of research:</u>
  - On the composition of food products (Ciqual)
  - For setting up a food quality monitoring centre, and for tracking food supply developments

Pasta, SIFPAF

- Promote the consumption of all types of pasta, including those rich in fibre, via the International Pasta Organisation (IPO), currently being formed
- Update regulations that currently define a positive list of ingredients, thereby limiting pasta composition possibilities
- Include the claim "source of, and rich in, complex carbohydrates" in community regulations

Ice creams & sorbets SNF/PS SF /G

- Pursue the ongoing reduction of fat concentrations in ice cream
- Optimize the nutritional composition of sorbets?

Soft drinks, SNBR

- Develop drinks with reduced sugar content (no sweeteners)
- Develop drinks with different sugars and sweeteners to reduce caloric intake, using only small amounts of each
- Develop "light" drinks
- Consider reducing the size of portions
- Develop nutritional labelling

Fruit juice, UNIJUS

- Improve the possibility for the consumer of differentiating fruit juice and nectar, especially in commercial catering
- Develop nutritional labelling
- Develop communication for promoting balanced breakfasts

Nectars, UNIJUS
- Partly substitute added sugars with fruit juice rich in sugars (e.g. grape juice)
- Reduce added sugars, backed by a communication campaign to help consumers appreciate the less sweet taste?
- Change regulations to allow the addition of texture agents or fibres (use of a bulking agent)

Cordials, Syndicat des Sirops (association of cordials)
- Envisage recommending increased dilution (strengthen flavours to allow for increased dilution)
- Develop nutritional labelling

Dairy products, Syndifrais
- Reduce added simple carbohydrate content either by innovation, or by reformulation via a gradual reduction (a few percent) on yoghurts, flavoured fromage frais/fromage frais with fruit, and on the most popular milk desserts (children)
- Develop nutritional information
- Reduce the size of portions for children (as possible)
- Incorporate a carbohydrates section in nutritional charters

Compotes, Adepale
- Continue the gradual reduction in average sugar content to converge with levels in fresh fruit

Jams, Adepale
- Update regulations to reduce the minimum sugar content from 60% to 55% (in progress - DGCCRF)

Canned fruit, Adepale
- Envisage the development of products in water (or in natural fruit juice), products sweetened with grape juice, products with light syrup

Toasted bread and industrial pre-packed sandwich bread, Alliance 7
- Leverage the optimization of complex carbohydrates and fibres through the choice of high-quality source materials (explore the possibility of whole-grain cereals, less refined flour, etc.)

Industrial, pre-packed viennoiseries, Alliance 7
- Envisage a reduction to a level deemed acceptable by the consumer (in line with a lower existing level)
- Consult with the INBP for incorporating certain elements into training given to bakers; envisage guides of good practice for non pre-packed viennoiseries sold in small-scale bread and pastry shops (accounting for almost 95% of the French market)

Biscuits, Alliance 7
- Obtain a commitment by millers to encourage greater accessibility to whole-grain flours
- Envisage a slight, progressive reduction in existing products, backed by public communication
- Release new "light" products on the market that benefit from a corresponding claim
- Develop consumption reference points on labelling to encourage reasonable, balanced consumption within structured meals (breakfast, snack)

Breakfast cereals, Alliance 7
- Gradually reduce added simple carbohydrate content by reformulating or innovating via small reductions to avoid shifts in consumption: product more nutritious for breakfast

Confectionery, Alliance 7
- Sweetening agents and polyols appear to be the only possibility in terms of optimizing nutritional quality, and are in fact already widely used (in the absence of other codes of practice)

Chocolate, Alliance 7
- No alternative to traditional chocolate or to chocolate "with no sugars added" using sweeteners
- Develop nutritional labelling
- Establish a deontology charter

Cereal binders, USIPA
- Continue the development of ingredients that optimize nutritional composition in terms of simple & complex carbohydrates and fibres, and raise consumer awareness on this matter

Mass marketing food products, FCD
- Develop nutritional labelling (80% of private brand products by the end of 2007) with indications by portion, appraisal of visual labelling used per company name, and evaluation with the European Commission
- Reduce simple carbohydrate levels when revising existing recipes and creating new products in calls for tender to manufacturers; implementation of an indicator (July 2006)
- Organize nutritional training for employees (store personnel)
- Continue efforts at the cash desk (non-food products, sugar-free products or for adults)
- Provide consumers with nutritional information (in-store, call centres, etc.), distribute PNNS points of reference

Traditional, small-scale sector and independent retail trade, CGAD
- Reduce the amount of sugars if technically possible, and if welcomed by customers
- Reduce the size of portions
- Offer desserts (fresh fruit, etc.) other than cakes in lunchtime menus, without transforming companies into fruit and vegetable vendors
- Provide a consumer information guide aimed at professionals, including a chapter on nutritional information: nutritional composition of products, nutritional claims, nutritional approach (giving information on a balanced diet, producing products that combine taste and nutritional value, etc.)

Industrial catering providers
- Provide training resources to those responsible for purchasing
- Work with manufacturers sector by sector

Bread, flour, INBP / ANMF
- Validate the acceptability of bread made with type 80 flour, and study its satiation
- Encourage the use of type 65 flour instead of type 55 flour for everyday bread, including French traditional bread

Fast foods, Mac Donald's
- Continue the process for optimizing the nutritional composition of menus and products concerning fat, salt and sugars
- Install drinking fountains, or provide water carafes
- Distinguish simple carbohydrates from complex carbohydrates in nutritional labelling

On this basis, sector-specific meetings were organized in December 2006 to further discuss dedicated courses of action that could be examined with a view to drawing up charters (step 3 of the commission).

The sectors' representatives all affirmed the extensive awareness-raising of their colleagues as a result of the work carried out, not to mention their desire to continue their involvement in this process.

5. Conclusion

This project for exchanging information on carbohydrates among task force members has made it possible to establish the status of current data pertaining to carbohydrates in terms of production, consumption and food composition. On the basis of this work, the task force has been able to make headway in partnership with the agri-food industries on appropriate courses of action in line with public health objectives. This has been done by analysing the constraints, in particular technological, and the various impacts to be considered: nutritional, behavioural, toxicological and economic. These courses of action will lead to commitments on behalf of those sectors concerned (step 3), partly investigated through this project. These commitments will be formalized on the basis of specifications defining the criteria that economic actors will have to develop to express their involvement[7]. The AFSSA follow-up study on carbohydrates, together with the food quality monitoring centre, once operational, will serve to monitor food supply developments in terms of nutrition.

In addition to attaining these objectives, one of the noteworthy results of this project has been the initiation of dialogue and partnership dynamics. This can be illustrated in particular by the following:

- The constant presence of the various members, especially the agri-food sectors, administrations (DGAL, DPEI, DGCCRF, DGAS, DGS), consumers (UFC-Que Choisir, CLCV) and the AFSSA.
- The execution of ad hoc studies for providing the task force with recent data (retrieval of data from Crédoc surveys on certain food categories (fruit juice, soft drinks, low-sugar products); the study on actions carried out in European countries; TGE study; SCEES study).
- The systematic presentation of elements useful for the task group in accordance with the first two steps of the commission by the various agri-food sectors and manufacturers-users (AFSSA, Crédoc, INSEE).
- Data exchanges beyond the carbohydrates issue between public and private sectors, followed by distribution of data (in particular composition data for the CIQUAL)
- Dialogue between the members for implementing or publishing studies on carbohydrates (AFSSA and INSEE studies).

Above all, the desire by all concerned to continue these exchanges and extend them to other similar issues (e.g. lipids) bears testimony to the merit and success of such an undertaking. These exchanges have brought about mutual understanding of the expectations and constraints of the different actors involved, as well as heightened awareness of the nutritional issues on the one hand, and the technological and economical issues on the other hand.

[7] In December 2006, a committee was assigned with re-writing these specifications, subsequently made available in March 2007.

ANNEXES

Annex 1: List of abbreviations

DGAL	Direction Générale de l'Alimentation – DG for Food
DGAS	Direction Générale de l'Action Sociale – DG for Social Action
DGS	Direction Générale de la Santé - DG for Health
DGPEI	Direction Générale des Politiques Economique, Européenne et Internationale – DG for Economic, European and International Policy
BAEP	Bureau de l'Analyse Economique et de la Prospective – Bureau for Economic Analysis and forecasting
DGESCO	Direction Générale de l'Enseignement Scolaire – DG for School Education
DGCCRF	Direction Générale de la Concurrence, de la Consommation et de la Répression des Fraudes – DG for Competition, Consumption and Fraud Control
SCEES	Service Central des Enquêtes et Etudes Statistiques du Ministère de l'Agriculture et de la Pêche – Ministry of Agriculture's Central Office for Statistical Surveys and Studies
ENGREF	Ecole Nationale du Génie Rural des Eaux et Forêt – French Institute of Forestry, Agricultural and Environmental Engineering
ANIA	Association Nationale des Industries Agroalimentaires – French Association of Agri-food Industries
CEDUS	Centre d'Etudes et de Documentation du Sucre – Sugar Research and Documentation Centre
SNBR	Syndicat Nationale des Boissons Rafraîchissantes – French Soft Drinks Association
UNIJUS	Union Nationale Interprofessionnelle des Jus de fruits – National Interprofessional Fruit Juice Association
USIPA	Union des Syndicats des Industries des Produits Amylacés et de leurs dérivés – Central Labour Union for Starch Products and their Derivatives
ATLA	l'Association de la Transformation Laitière Française – French Milk Transformation Association
SIFPAF	Syndicat des Industriels Fabricants de Pâtes Alimentaires de France – French Pasta Manufacturers Association
Alliance 7	The Alliance is an interunion association operating in 9 food sectors: Chocolate, Biscuits, Confectionary, Breakfast cereals, Bread, Honey, Various foods, Baby foods and clinical nutrition, Dietetic foods and supplements
INBP	Institut National de la Boulangerie Pâtisserie – French Baking and Pastry-making Institute
CGAD	Confédération Générale de l'Alimentation en Détail – Food Retailers Confederation
ASPCC	Association Sucre-Produits sucrés, Communication, Consommation – Sugar and Sweet Products Association, Communication, Consumption
SFIG	Syndicat des Fabricants Industriels de Glaces, de sorbets et crèmes glacées – Federation of Ice Cream and Sorbet Manufacturers
SYNPA	Syndicat National des Producteurs d'Additifs et d'ingrédients de la chaîne alimentaire – French Food Additives and Ingredients Manufacturers Association
GECO CH	Groupe d'Etude de la Consommation hors foyer – Out-of-home Consumption Task Force
SYNDIFRAIS	Syndicat National des Produits Laitiers Frais – Association of French manufacturers of fresh dairy products
FCD	Fédération des entreprises du Commerce et de la Distribution – Federation of Commerce and Distribution Businesses
ANMF	Association Nationale de la Meunerie Française – Association of French Flour-milling
ADEPALE	Association des Entreprises de Produits Alimentaires Elaborés8 – Association of Food Processing Industries

[8] Comprises six professional associations in the food processing sector (ADISUR, FIAC, PFD, STF, SYNAFAP and SYNDEPAL) ADISUR: Association pour le Développement des Industries du Surimi - Association for the Development of the Surimi Industry
FIAC: Fédération Française des Industries d'Aliments Conservés – French Federation of Canned Food Industries
PFD: Syndicat National des Fabricants de Produits à base de Fruits, Sucres et Dérivés - French Association of Manufacturers of Fruit and Sugar-based Products and By-products
STF: Syndicat du Saumon et de la Truite Fumés – Association of Smoked Salmon and Trout
SYNAFAP: Syndicat National des Fabricants de Plats Préparés Frais – French Association of Fresh Ready Meals
SYNDEPAL: Syndicat National des Déshydrateurs de Produits Alimentaires – French Assocation of Food Dehydrators

CCC	Restauration collective en gestion directe – Direct Management Catering
SNRC	Syndicat National de la Restauration Collective – French Contract Catering Association
ENSIA	Ecole Nationale Supérieure des industries agricoles et agroalimentaires – French Food Science Engineering School
FIRS	Fonds d'intervention et de Régularisation du marché du Sucre – Sugar Market Intervention and Stabilization Fund
CIQUAL	Centre Informatique sur la Qualité des Aliments – Informatics Centre for Food Quality (a scientific and technical support unit of the French Agency for Food Safety)
EIWA	Energy Intake Without Alcohol
INSEE	Institut national de la statistique et des études économiques - National Institute for Statistics and Economic Studies
INSERM	Institut national de la santé et de la recherche médicale - National Institute for Health and Medical Research
CREDOC	Centre de Recherche pour l'Etude et l'Observation des Conditions de vie – Research Centre for the Study and Observation of Living Conditions
INCA	enquête Individuelle et Nationale sur les Consommations Alimentaires – Individual and National Survey on Food Consumption

Annex 2: Food categories – carbohydrate and fibre content

➔ Pasta

Source: SIFPAF, Ciqual table for 100g of cooked pasta
Total available carbohydrates: 22.2g
Simple carbohydrates: 0.5g
Starch: 21.7g
Fibre: 2g

➔ Dairy products

Source: Syndifrais
Intrinsic carbohydrates:

- Natural products: lactose, only simple carbohydrate (17% of fresh dairy products): 3-4g/100g
- With fruit: fructose: low quantity (12-15g of total carbohydrates/100g)
- With cereals or milk desserts (rice pudding, etc.): complex carbohydrates (17-22g of total carbohydrates/100g)

Added simple carbohydrates: mainly sucrose, sometimes glucose, fructose, glucose syrup or fructose

➔ Soft drinks

Source: SNBR
Soft drinks: 10g of sugars (usually sucrose)/100ml
"Light" drinks: no sugars, intense sweeteners
Low sugar drinks (with or without sweeteners): 3.5 – 6g of sugars/100ml

➔ Compote, jam, canned fruit

Source: Adepale
Sugar content in apples, natural or processed:

For 100g	Raw apple with skin	Raw apple without skin	Boiled apple without skin	Apple compote "low in sugars"
Total sugars (g)	10.4	10.1	11	16.5
Sucrose (g)	2.1	0.8	n/a	4.7
Glucose (dextrose) (g)	2.4	3.2	n/a	4.3
Fructose (g)	5.9	6	n/a	7.5

Source: US Department of Agriculture, 2005

A rough estimate determines that 100g of raw apples are needed to produce 100g of compote. The amount of added sugars in a low sugar compote therefore represents approximately 39% of the total sugars in the compote in the USDA table.

Commercial denomination	**% of sugars**
Jam	>60
(Prepared fruit)	45-60
Low sugar jam	42-45
Compote	24-40
(Fruit dessert)	18-24
Low sugar compote	16-18
Lightly sugared fruit purée	< 16 with added sugars
Fruit purée	No sugars added, >10-11

"Fruit in syrup"
Sugar content, measured by refractometer at 20°C:

- 9 - 14% exclusive for "very light syrup",
- 14 - 17% exclusive for "light syrup",
- 17 - 20% exclusive for "syrup",
- 20% and above for "heavy syrup"

➔ Crusty and soft bread products, Viennoiseries

*Source: Alliance 7, Syndicat national de la biscotterie et de la panification fine, (French biscotte and specialty bread-making association), Ciqual, *corporate data*

Content in g/100 g	Total carbohydrates	Of which starch	Of which sugars	Fibres
Industrial toast ("biscotte")	74	71	3	4
Toasted bread*	70	64	6	6
Sandwich bread	50.3	48.3	2	3.1
Whole-grain sandwich bread*	44	38	6	4.8
American mixed-cereal sandwich bread*	43.3	32	4.4	4.8
Bun ("brioche")	40.5	35.5	5	2.6
Milk bread bun	47	44.2	2.8	2.5
Croissant	55	47.5	7.5	2.2

➔ Biscuits and pre-packed cakes

Source: Alliance 7, Syndicat de la biscuiterie française (French biscuit-making association)

Composition in g /100g	Starch	Simple carbohydrates	Fibre
Dry biscuits	51.5	22.5	3
Chocolate biscuits	35	30.5	2.9
Fruit wafers	23.9	53.9	3
Soft biscuits	11.3	53.9	3

➔ Chocolate

Source: Alliance 7, Chocolate association
20-75% of carbohydrates (sugars and starch)
Fibre (up to 6g/100g of dark chocolate)

➔ Confectionery

Source: Alliance 7, Chambre syndicale nationale de la Confiserie (French confectionery association)

Composition in g/100g	Classic sweet/candy	Sugar-free sweet/candy with sweeteners
Carbohydrates	95	95
- of which sugars	50 - 85	0
- of which polyols	0	95

➔ **Breakfast cereals**

Source: Alliance 7, Syndicat français des céréales prêtes à consommer ou à préparer (French association of ready-to-eat cereals/cereals for preparation)

Composition in g / 100g	**Total carbohydrates**	**Total sugars**	**Starch**	**Fibre**
Oat flakes	63	2	61	7.5
Muesli	65	26	39	5.5
"Slimness and healthy" cereals	75.5	22	53.5	4
Cereals rich in fibre (average)	67	22	45	15
Cereals with chocolate	80	36	44	4
Cereals with honey, caramel…	83	35	48	3

➔ **Ice creams, sorbets**

Source: SNF/PS SF /G
Little variation: 160g of carbohydrates/litre of ice cream

➔ **Bread**

Source: INBP – ANMF
Type 65 flour represents 50% of flour used by small-scale bread and pastry shops, i.e. approximately 730,000 tonnes. Flour incorporated in mixtures (preparations for special types of bread) represented more than 113,000 tonnes in 2005 (in 2005, 4.3% of flour used went into making mixes for special bread).

➔ **Fruit juice, nectars**

Source: UNIJUS
Fruit juice: on average, approximately 100g of native sugars per litre
Nectars: 100g of native sugars per litre

➔ **Cordials**

Source: Syndicat des Sirops (Association of cordials)
For 100g: 63g of simple carbohydrates

Annex 3: Carbohydrate intake trends

Table 1: Trends in contributions by macronutrients to energy intakes without alcohol (%EIWA) for the period 1994-2003 (ASPCC–INCA-CCAF surveys)

	ASPCC 1994		INCA 1999		CCAF 2003		Significance INCA / CCAF
	N=232		N=1018		N=1090		
Children	Av.	SD	Av.	SD	Av.	SD	
EIWA (kcal/d)	1757	37	1903	18.5	1864	15.9	0.1009
Carbs (%EIWA)	45.7%	0.4	46.6%	0.2	49.7%	0.2	0.0001
Lipids (%EIWA)	38.6%	0.4	37.7%	0.1	35.1%	0.1	0.0001
Proteins (%EIWA)	15.7%	0.2	15.8%	0.1	15.3%	0.1	0.0001
Simple carbs (%EIWA)	22.1%	.	23.2%	0.2	22.5%	0.2	0.0197
Adults	N=929		N=1474		N=1361		
EIWA (kcal/j)	1988	17.6	2119	14.1	2062	13.5	0.0038
Carbs (%EIWA)	40.5%	2.3	43.5%	0.2	45.1%	0.2	0.0001
Lipids (%EIWA)	41.5%	1.0	38.8%	0.1	37.7%	0.2	0.0001
Proteins (%EIWA)	18.0%	0.8	17.7%	0.1	17.1%	0.1	0.0001
Simple carbs (%EIWA)	17.3%	.	17.8%	0.2	16.2%	0.2	0.0001

Table 2: Trends in total, complex and simple carbohydrate intakes (g/day) for the period 1994-2003 (ASPCC–INCA-CCAF surveys)

	ASPCC 1994		INCA 1999		CCAF 2003		Significance INCA / CCAF
Children	Av.	SD	Av.	SD	Av.	SD	
Energy (kcal/d)	1759	37.1	1905	18.5	1864	15.9	0.0959
Total carbs (g/d)	203	5.1	223	2.5	232	2.1	0.0095
Complex carbs (g/d)	106	3.3	114	1.7	127	1.4	0.0001
Simple carbs (g/d)	97	3	109	1.3	104	1.2	0.0074
SC/TC (%)	47.8%	0.7	49.4%	0.3	45.2%	0.3	0.0001
Adults							
Energy (kcal/d)	2131	19.6	2221	15.0	2171	14.3	0.0164
Total carbs (g/d)	207	2.3	234	2.0	236	1.9	0.4456
Complex carbs (g/d)	121	1.5	138	1.5	150	1.3	0.0001
Simple carbs (g/d)	86	1.3	96	1.0	86	1.0	0.0001
SC/TC (%)	41.5%	0.4	41.5%	0.3	36.5%	0.3	0.0001

Annex 4: Contribution by foods to carbohydrate intakes

Table 1: contribution by foods to complex carbohydrate intakes; source CREDOC - CCAF survey, 2004

	Children			Adults	
	CC (% g/d)	Energy (% kcal/d)		CC (% g/d)	Energy (% kcal/d)
Bread, Toasted bread	29.3%	10.4%	**Bread, Toasted bread**	48.6%	17.2%
Potatoes and similar	9.0%	4.3%	**Potatoes and similar**	8.0%	3.6%
Hot drinks	8.5%	5.5%	**Mixed dishes**	6.0%	7.4%
Breakfast cereals	8.0%	4.1%	**Cakes, pastries**	5.3%	5.6%
Viennoiseries	6.8%	4.2%	**Pasta**	4.5%	1.6%
Mixed dishes	6.0%	6.6%	**Rice, Semolina, Wheat**	4.1%	1.3%
Pasta	5.8%	2.1%	**Viennoiseries**	4.1%	2.6%
Cakes, pastries	5.8%	6.4%	**Pizzas, quiches, Danish pastry**	3.9%	3.1%
Sweet biscuits	4.4%	3.6%	**Sandwiches, Snacks**	3.2%	2.0%
Rice, Semolina, Wheat	3.9%	1.2%	**Hot drinks**	2.3%	2.3%
Pizzas, quiches, Danish pastry	3.4%	2.7%	**Soups**	2.3%	1.6%
Sandwiches, Snacks	2.6%	1.7%			
	93.6%	**52.9%**		**92.2%**	**48.2%**

Table 2: contribution by foods to simple carbohydrate intakes; source CREDOC - CCAF survey, 2004

	Children			Adults	
	SC (% g/d)	Energy (% kcal/d)		SC (% g/j)	Energy (% kcal/d)
Juices and nectars	10.1%	2.5%	**Sugar, jam, honey, syrup, etc.**	15.9%	2.6%
Soft drinks	8.5%	2.1%	**Fresh fruit**	15.8%	2.7%
Fresh fruit	8.4%	2.1%	**Cakes and pastries**	8.2%	5.6%
Yogurts and fermented milk	7.9%	3.0%	**Yogurts and fermented milk**	7.0%	2.0%
Cakes and pastries	7.0%	6.4%	**Soft drinks**	5.5%	1.2%
Breakfast cereals	6.7%	4.1%	**Juices and**	4.5%	0.9%
Sugar, jam, honey, syrup, etc.	6.6%	1.5%	**Bread, Toasted bread**	4.2%	17.2%
Chocolate, chocolate bars	5.9%	3.2%	**Vegetables (excluding potatoes)**	4.0%	1.4%
Hot drinks	5.3%	5.5%	**Hot drinks**	3.8%	2.3%
Milk	4.7%	2.7%	**Mixed dishes**	3.8%	7.4%
Sweet biscuits	4.0%	3.6%	**Alcoholic drinks**	3.3%	4.8%
Cream desserts, flans	3.1%	1.3%	**Cream desserts, flans**	3.2%	1.0%
Ice creams, sorbets and ice lollies	2.4%	1.0%	**Chocolate, chocolate bars**	2.2%	0.9%
Compotes and stewed fruit	2.4%	0.5%	**Soups**	2.1%	1.6%
Mixed dishes	2.2%	6.6%	**Rice pudding, mousse, clafoutis, tiramisu**	2.0%	0.7%
Drinking yogurts and Actimel	2.2%	0.8%	**Sweet biscuits**	2.0%	1.4%
Vegetables (excluding potatoes)	2.1%	1.1%	**Compotes and stewed fruits**	1.8%	0.3%
Confectionery	1.9%	0.5%			
	91.3%	**48.5%**		**89.3%**	**54.0%**

Table 3: Contributions to simple carbohydrate intakes among children by age; source: CREDOC - CCAF survey, 2004

3-6 year-olds	SC (% g/d)	7-10 year-olds	SC (% g/d)	11-14 year-olds	SC (% g/d)	15-24 year-olds	SC (% g/d)
Juices and nectars	9.7%	Juices and nectars	10.5%	**Soft drinks**	11.7%	**Soft drinks**	14.7%
Yogurts and fermented milk	9.3%	**Fresh fruit**	8.8%	Juices and nectars	10.1%	**Fresh fruit**	10.2%
Fresh fruit	8.4%	Cakes, pastries	7.5%	**Fresh fruit**	8.1%	Sugar, jam, honey, syrup...	9.4%
Sugar, jam, honey, syrup...	6.9%	**Soft drinks**	7.4%	**Yoghurts and fermented milk**	7.1%	Cakes, pastries	8.1%
Soft drinks	6.8%	**Breakfast cereals**	7.4%	Cakes, pastries	7.0%	**Yoghurts and fermented milk**	6.9%
Hot drinks	6.6%	**Yoghurts and fermented milk**	7.2%	**Breakfast cereals**	7.0%	Juices and nectars	6.9%
Cakes, pastries	6.4%	Sugar, jam, honey, syrup...	6.3%	Sugar, jam, honey, syrup...	6.6%	Chocolate, chocolate bars	5.1%
Breakfast cereals	5.6%	Chocolate, chocolate bars	6.3%	Chocolate, chocolate bars	6.3%	**Breakfast cereals**	4.7%
Milk	5.3%	Milk	4.8%	Hot drinks	4.6%	Hot drinks	3.7%
Chocolate, chocolate bars	5.0%	Hot drinks	4.6%	Milk	3.8%	Mixed dishes	3.4%
Biscuits	4.6%	**Biscuits**	4.1%	**Biscuits**	3.4%	Cream desserts, flans	3.3%
Drinking yoghurts	3.1%	Cream desserts, flans	3.2%	Cream desserts, flans	3.0%	**Biscuits**	2.9%
Cream desserts, flans	3.1%	Compotes, fruit in syrup	2.5%	Mixed dishes	2.7%	Vegetables (excluding potatoes)	2.4%
Compotes, fruit in syrup	2.9%	Ice creams, sorbets, ice lollies	2.4%	Ice creams, sorbets, ice lollies	2.5%	Bread, Toasted bread	2.4%
Ice creams, sorbets, ice lollies	2.3%	Drinking yoghurts	2.3%	Vegetables (excluding potatoes)	2.4%	Milk	2.3%
Confectionery	2.0%	Vegetables (excluding potatoes)	2.2%	Bread, Toasted bread	2.1%	Rice pud., mousse, clafoutis,	2.2%
Vegetables (excluding potatoes)	1.8%	Mixed dishes	2.1%	Rice pud., mousse, clafoutis,	1.9%	Ice creams, sorbets, ice lollies	1.9%
Mixed dishes	1.8%	Confectionery	1.9%	Compotes, fruit in syrup	1.7%	Compotes, fruit in syrup	1.5%
Rice pud., mousse,clafoutiss,tiramisu...	1.4%	Bread, Toasted bread	1.7%	Confectionery	1.7%	Viennoiseries	1.2%
	93.2%		**93.0%**		**93.4%**		**93.1%**

Annex 5: Summary of actions taken

Sectors	**Food composition**	**Other actions**
Pasta Source: SIFPAF		- ARN (Alimentation, Recherche et Nutrition – Food, Research and Nutrition) EIG: research on the value of complex carbohydrates and population awareness-raising - Promotion through the International Pasta Organization and the World Pasta Day
Dairy products Source: Syndifrais	- In 2005: "sugar-free" offer = 40% of which "with no sugars added" = 32.4% and "with sweeteners" = 7.4% (*survey with 6 manufacturers representing 77% of the market*): - Reduction of added sugars, through reformulations, ranging from a few percent to 10% - Massive reduction (from 10 - 25% of added simple carbohydrates) or complete elimination on specific products ("light" range with sweeteners).	- Initiatives for reducing the size of portions for children - Nutritional information (labelling, Internet, brochures, etc.)
Soft drinks Source: SNBR	- Drinks with no sugars added, with intense sweeteners ("light" = 20% of the market) - Drinks low in sugars with sweeteners (to maintain sweet taste) = 2.3% of the market - Drinks low in sugars with no sweeteners (less sweet taste) = 8% of the market	- Nutritional labelling on all products -Participation in programmes for encouraging physical activity
Compote, jams, canned fruit Source: Adepale	- Reduction in sugar content as far as possible according to regulatory denominations ("jam" = min. 60% sugars; "compote" = virtually disappeared except for compotes with pieces of fruit; "canned fruit" - trial runs for "natural", using grape juice or light syrup: little consumer enthusiasm, except for individual portions with light syrup) - Development of products with less sugars, using new denominations ("fruit dessert", "light compote" (especially in bottles/flasks), "light jam" = 19% of market share in 2005) - Development of "fruit purées" with no sugar added (market share progressed from 4 to 12% between 2003 - 2006)	- New packaging: reduced sizes equivalent to a serving of fruit (small dishes and flasks = 81% of the market) and containing low-sugar products) - New mixtures of fruit, diversification of the offer to attract new consumers
Soft and crusty bread products, Industrial pre-packed viennoiseries Source: Alliance 7 French biscotte and specialty bread-making association	- Soft and crusty bread products: very little sugar, andtechnological necessity; development of "whole-grain products, products "with bran", "with cereals", "with wheat germ" - Industrial, pre-packed viennoiseries: optimizations on quantity and quality of fat; only one product launched with 20% less sugars	
Biscuits and pre-packed cakes/pastries Source: Alliance 7 French biscuit association	For the past 2-3 years: - Reformulation of existing products (for sugars and fat) - Launch of new products rich in fibre and complex carbohydrates	- Reduction in the size of portions and packets - Biscuit-making deontology charter: quality, clear information for the consumer on nutrition and dietary behaviour to encourage reasonable consumption (recommendations, respectable advertising, non-idealization, etc.) - "Reference points approach": indications on the packaging: taking into account the moment of consumption, the consumer's profile, the type of biscuits
Chocolate Source: Alliance 7 Chocolate association	- No reformulation for existing products due to specific image (pleasure, enjoyment, mythical), but launch of new products "with no sugars added" and "low in carbohydrates" but with a higher calorific value, and containing polyols or intense sweeteners	- Size of portions: reduction in the size of chocolate bars, or mini version - Systematic nutritional labelling

Confectionery Source: Alliance 7 French confectionery association	- Development, for the past 10 years, of the "sugar-free" offer: 91% in the chewing gum market, 60% in confectionery/sweets	- Transparency regarding sugar content, associated with quality in traditional confectionery (see the trade's deontology charter)
Breakfast cereals Source: Alliance 7 French association of ready-to-eat cereals or cereals for preparation	For the past 2 years, all manufacturers have reduced amounts of sugars, including the market's 3 leaders (85% of the market share), but recipes do not always meet with success: - New cereals with 9 – 25% less sugars - Reformulation of existing recipes: use of at least 20% whole-grain cereals and 4 – 10% less sugars	- Information, nutritional labelling for 100g and per portion - Balanced breakfast promotion - Trade deontology charter: safety and quality / clear information for the consumer on reasonable consumption, respectable advertising, non-idealization, etc. Information accessibility (Internet, leaflets, consumer service, etc.)
Ice cream, sorbets Source: SNF/PS SF /G	- Regular, limited reduction given sugar's technological role and level of incorporation - Alternatives using intense sweeteners and bulking agents, not particularly popular with the consumer, and more expensive (light products account for 2.8% of the market)	
Bread Source: INBP – ANMF	Individual or association-based initiatives (e.g. "Pain Qualité Santé" - Bread Quality Health) Special bread with higher type flour and with grains.	
Fruit juice, nectars Source: UNIJUS	- No fruit juices contain added sugars (despite the fact that regulations allow it) - Commercial failure of nectars with intense sweeteners	- Nutritional labelling (75% of products)
Cordials Source: Syndicat des Sirops	- Cordials with intense sweeteners and flavours in accordance with the provisions of the by-law - "Sugar-free" or "low in sugars" innovations, but loss of the "cordials" denomination	- Advice on dilution for a drink with less sugars
Mass market food products Source: FCD	- Reduction in sugar content through reformulation of existing recipes - New references, sugar content criterion - Transverse indicator on reductions in sugars (in progress)	- Development and improvement of nutritional labelling (2007: 80% of private-brand products with Group I or II labelling; 2008: almost all with indications per portion) - Awareness-raising and training concerning nutrition (how to eat well) for store staff - Modification of assortments at the cash desk (end of 2004: 80% of products sugar-free or non-food) - Promotion for consumption of fruit and vegetables (events, information, promotions, etc.)
Traditional small-scale sector and retail trade food products Source: CGAD	- Thought process underway on how to reduce simple carbohydrates if accepted by the consumer	- Thought process on reducing portion size - Diversification of desserts with fruit in lunchtime menus - Finalization of a guide for professionals to better inform the consumer, including a chapter on nutritional information

Annex 6: Simulation of nutritional intakes

Table 1.
Distribution of overall consumption of simple carbohydrates among adults (in grammes/day/person, N=1474)

	2006	2011		
		Low hypoth.	Central hypoth.	High hypoth.
Average	95.1	94.5	93.9	93.1
Standard deviation	38.8	38.5	38.3	38.0
10th percentile (P10)	52.2	51.8	51.5	51.1
1st quartile	69.2	68.7	68.0	67.5
Median	88.9	88.6	87.9	87.0
3rd quartile	116.1	115.1	114.2	113.5
90th percentile (P90)	142.9	141.2	140.4	138.7

Source: INCA survey, 1999, Afssa processing

Table 2.
Distribution of overall consumption of simple carbohydrates among children (in grammes/day/person, N=1018)

	2006	2011		
		Low hypoth.	Central hypoth.	High hypoth.
Average	107.2	106.4	105.3	104.0
Standard deviation	42.5	42.3	41.8	41.6
10th percentile (P10)	60.6	60.3	59.3	58.4
1st quartile	78.1	77.8	77.3	76.3
Median	103.9	103.0	101.7	100.5
3rd quartile	128.3	127.0	125.5	123.9
90th percentile (P90)	155.5	154.8	152.4	151.7

Source: INCA survey, 1999, Afssa processing

Tableau 3.
Distribution of overall consumption of fibre among adults (in grammes/day/person, N=1474)

	2006	2011		
		Low hypoth.	Central hypoth.	High hypoth.
Average	17.0	17.2	17.3	17.4
Standard deviation	6.1	6.1	6.2	6.2
10th percentile (P10)	10.2	10.4	10.4	10.5
1st quartile	12.7	12.8	12.9	12.9
Median	16.1	16.2	16.3	16.4
3rd quartile	20.3	20.6	20.7	20.8
90th percentile (P90)	24.7	25.0	25.0	25.1

Source: INCA survey, 1999, Afssa processing

Table 4.
Distribution of overall consumption of fibre among children (in grammes/day/person, N=1018)

	2006	2011		
		Low hypoth.	Central hypoth.	High hypoth.
Average	13.3	13.4	13.4	13.5
Standard deviation	5.4	5.4	5.5	5.5
10th percentile (P10)	7.4	7.5	7.5	7.5
1st quartile	9.6	9.6	9.6	9.6
Median	12.5	12.6	12.6	12.7
3rd quartile	15.7	16.0	15.9	16.0
90th percentile (P90)	20.2	20.5	20.5	20.6

Source: INCA survey, 1999, Afssa processing

Table 5.
Development in macronutrient intakes for different food groups among adults (in g/day/pers., N=1474) – Central hypothesis

2006				2011			
Carbs	Lipids	Proteins	Energy	Carbs	Lipids	Proteins	Energy
232.4	90.0	92.3	2204.0	231.3	90.1	92.3	2196.9

Source: INCA survey, 1999, Afssa processing

Table 6.
Development in macronutrient intakes for different food groups among children (in g/day/pers., N=1018) – Central hypothesis

2006				2011			
Carbs	Lipids	Proteins	Energy	Carbs	Lipids	Proteins	Energy
222.8	78.9	73.7	1898.5	221.3	79.0	73.8	1891.6

Source: INCA survey, 1999, Afssa processing

Annex 7: Possible sucrose substitutes – advantages/disadvantages

Extract from the AFSSA opinion in response to notification no. 2006-SA-0140

Table: possible sucrose substitutes – pros and cons

Constituent	**Advantage(s)**	**Disadvantage(s)**	**Overall benefit from the substitution and general comments**
Fructose	Less hyperglycemia-inducing than sucrose	Potentially hypertriglyceridemia-inducing	Less hyperglycemia-inducing than sucrose but risk of hypertriglyceridemia
Glucose/fructose or isoglucose syrup	Glycemia-inducing power situated between that of glucose and that of fructose (depending on the proportion of each sugar)	Drawbacks inherent in two constituent sugars. Once 50/50 = sucrose	No benefit for health
Intense sweetener(s) + malto dextrins	Globally reduces the level of hyperglycemia-inducing carbohydrates	Hyperglycemia-inducing. Insufficient data on the long-term nutritional effects of intense sweeteners at high doses	Limited to confectionery "with reduced energy content" (30% less energy) and "sugar-free" confectionery. Insufficient data on long-term effects at high doses
Intense sweeteners(s) + non-calorific bulking substance	Completely eliminates carbohydrate intake associated with the sweetening potential required	Insufficient data on the long-term nutritional effects of intense sweeteners at high doses	
Polyols, sugars, alcohol	Less calorific than sugars (2.4kcal/g). Anti-cariogenic. Mass-providing sweetener	Laxative effect at high doses	Limited to confectionery "with reduced energy content" (30% less energy) and "sugar-free" confectionery. Risk of diarrhoea (/high consumption)
Honey	Contains nutrients and molecules with potentially beneficial biological activities (e.g.: bacteriostatic activity, anti-fungal activity, etc.)	Glycemia-inducing properties similar to isoglucose. Almost also as high in energy as glucose syrup (for the same sugar concentration): 290kcal/100g for 80% MS	Almost as energetic and hyperglycemia-inducing as isoglucose; has potentially beneficial molecules
Vegetable origin fraction rich in fructose and glucose (e.g.: rectified concentrated grape must)	–	–	Inform the consumer on the fact that this is a source of simple carbohydrates