

# The quality of nutrients in a healthy balanced diet : carbohydrates

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# A great variety of structures: from a biochemical classification to a physiological one

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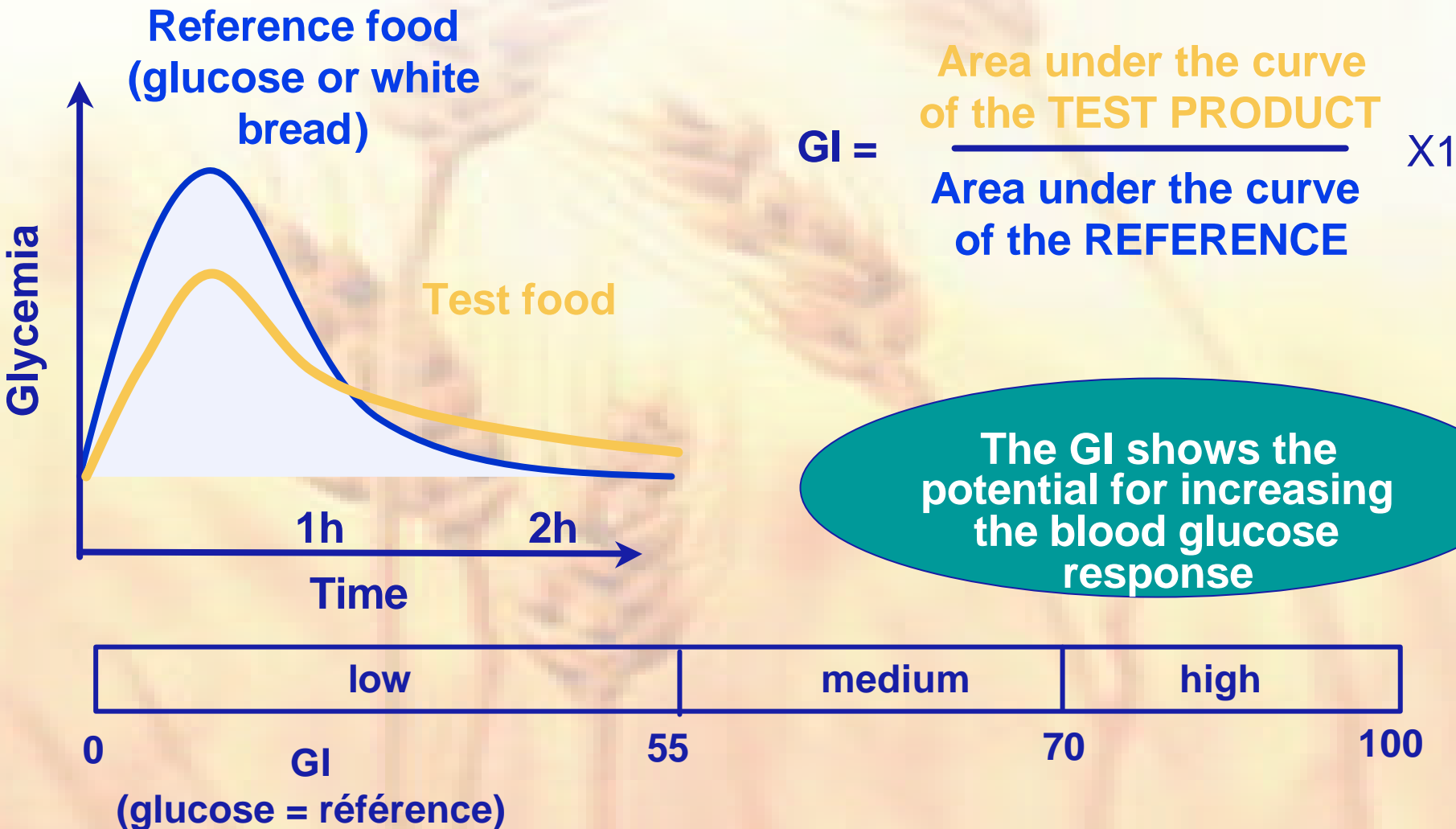
- Main energy source, in the form of sugar and starch + structural materials in the walls of plant-animal and bacterial cells
- Carbohydrates : element C, H and oxygen
- In 1998, FAO and WHO suggests that carbohydrates should be classified by molecular size, according to the degree of polymerisation (DP)
  - ➔ sugars (1-2), oligosaccharides (3-9), polysaccharides (>9), hydrogenated carbohydrates (polyols)
- to a tentative « nutritional » approach;
  - ➔ glycaemic /non glycaemic carbohydrates (FAO, WHO, 1998)
  - ➔ GI
  - ➔ slowly /rapidly available glucose
  - ➔ total sugars, added sugars, intrinsic sugars
  - ➔ fibers : soluble and insoluble

# Nutritional recommendations are changing and highlight the importance of carbohydrates in the diet

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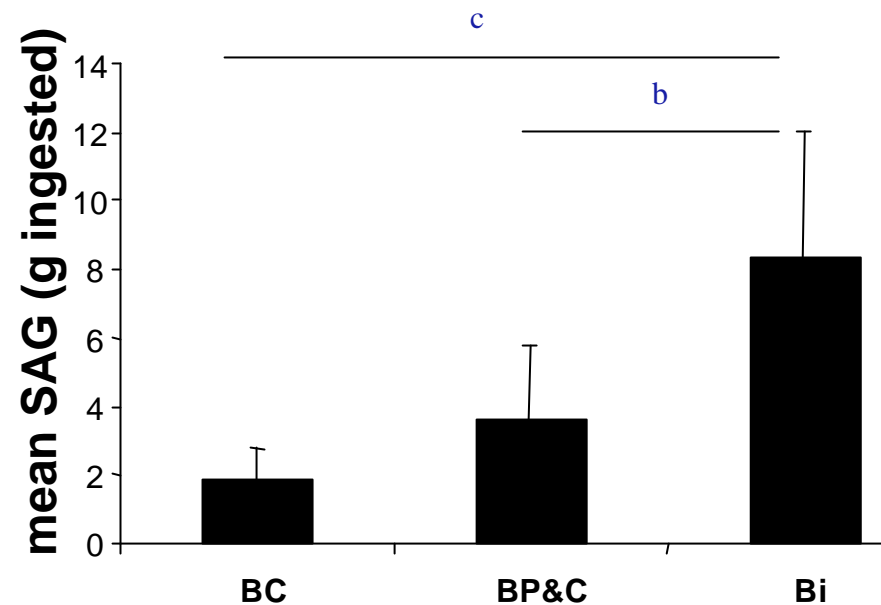
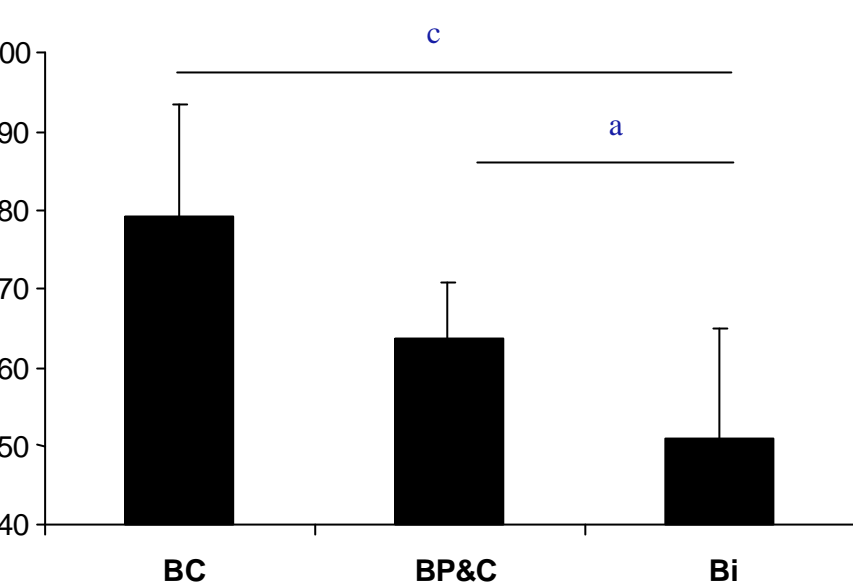
- Total carbohydrates > 55% of total energy intake
- Considering the public health issues, sugar consumption can be limited by some Authorities ( *Plan National Nutri Santé in France 2002*); free sugar restricted to 10 of total energy intake ( *FAO/WHO, 2003*)
- Encourage the fiber consumption
- In favor of the increase of complex carbohydrate consumption
- But , some national recommendations go further with recommendation of consumption of foods with low GI for specific targets of population. ( *Serra-Manjem, Aranceta 2001 Nutritional objectives for the spanish population*)

The glycaemic response shows the rise in the blood glucose when foods containing glycaemic carbohydrates are eaten



# Relationship between the quantity of slowly available glucose and GI in cereal food products

- Between these three categories of food products, biscuits have highest SAG with the lowest average of GI.

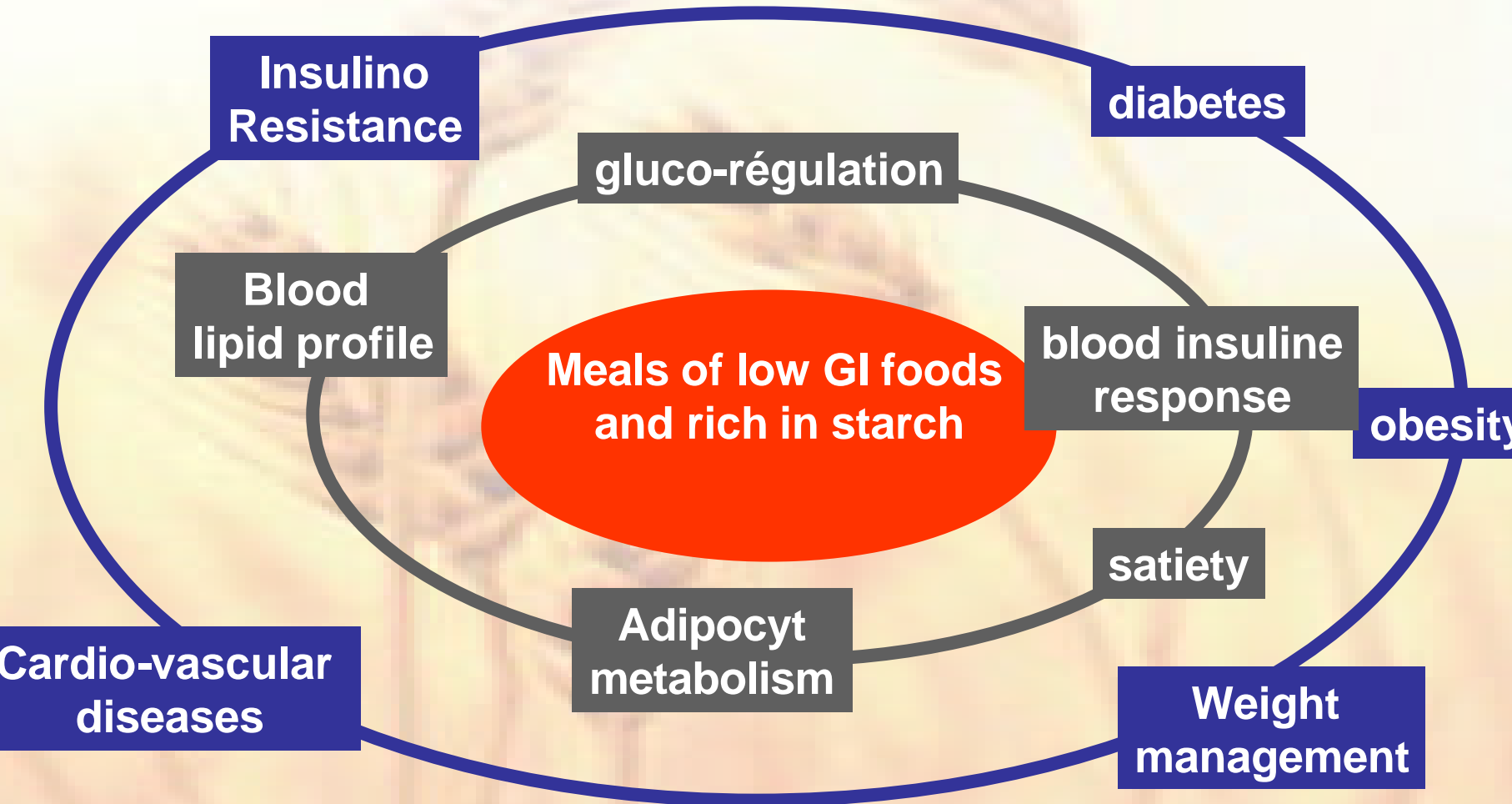


BC : breakfast cereals    BP&C : bread products and crackers

Bi : biscuits. means  $\pm$  SD ;    a, b, c :  $P < 0,05$

- SAG : Slowly available glucose, *in vitro* test of starch digestibility (Englyst, 2000)
- IG : WHO/FAO test (Glucose = référent = 100)

# Physiological effects of GI and their potential public health implications ( *to be confirmed by LT studies* )



# Food factors that can influence glycaemic response

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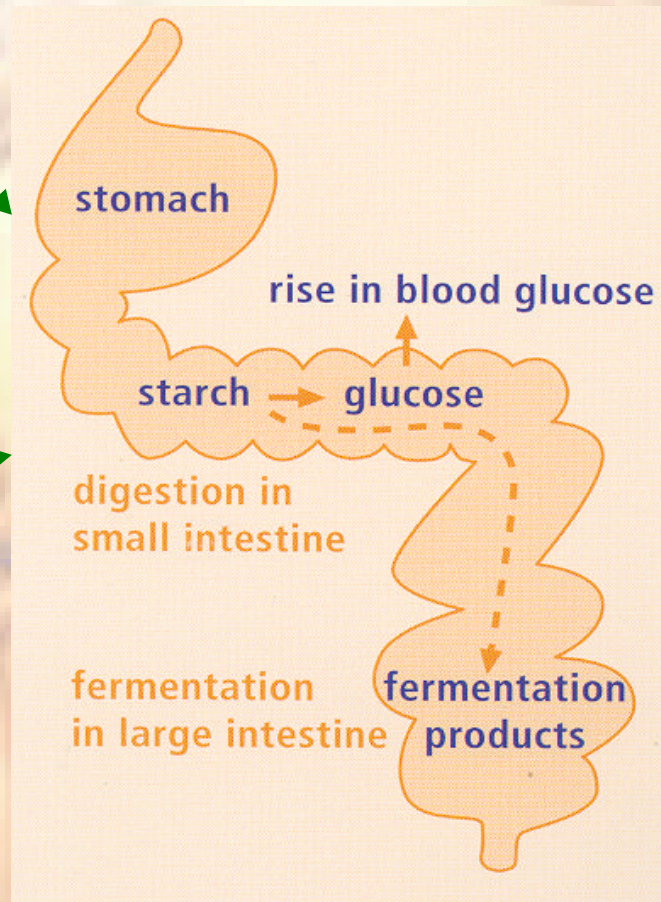
- Nature and amount of carbohydrate
- Nature of the monosaccharide components
  - ➔ glucose, fructose, galactose
- Nature of starch
  - ➔ amylose, amylopectin,
  - ➔ structure of starch grain
- Cooking and food processing
  - ➔ degree of gelatinisation of starch
- Other food components
  - ➔ fat and protein
  - ➔ dietary fibre...

# Overview of the EUROSTARON project

## "Stable isotope applications to monitor starch digestion and fermentation for the development of functional foods", 2002 - 2005

Effect of different origin of starch  
wheat, potatoes, oat / rye) on the properties of starchy foods

Effect of the food processing  
on the properties of starchy foods



Potential health benefits  
of slow release of glucose from starchy foods on - carbohydrate metabolism  
- satiety and weight control  
- concentration improvement

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## Conclusion

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- Carbohydrates provide 40 to 75% of total energy intake, thus constituting the most important energy source in human diets. In developed countries, carbohydrate (starch) intake declined over the second half of the past century.
- The FAO/WHO report on diet, physical activity and non-communicable diseases recommends an optimum carbohydrate level of at least 55% of total energy intake.
- The type of carbohydrate is variable and there is some restriction of sugar consumption on one hand and recommendation to increase fiber and complex carbohydrate consumption on another hand.
- A new concept is emerging based on the glycaemic response. The consumption of meals containing low GI foods is associated to reduced blood glucose and insulin response and improved lipid profiles. Long term studies are needed to confirm the potential preventive effect of low GI diet.