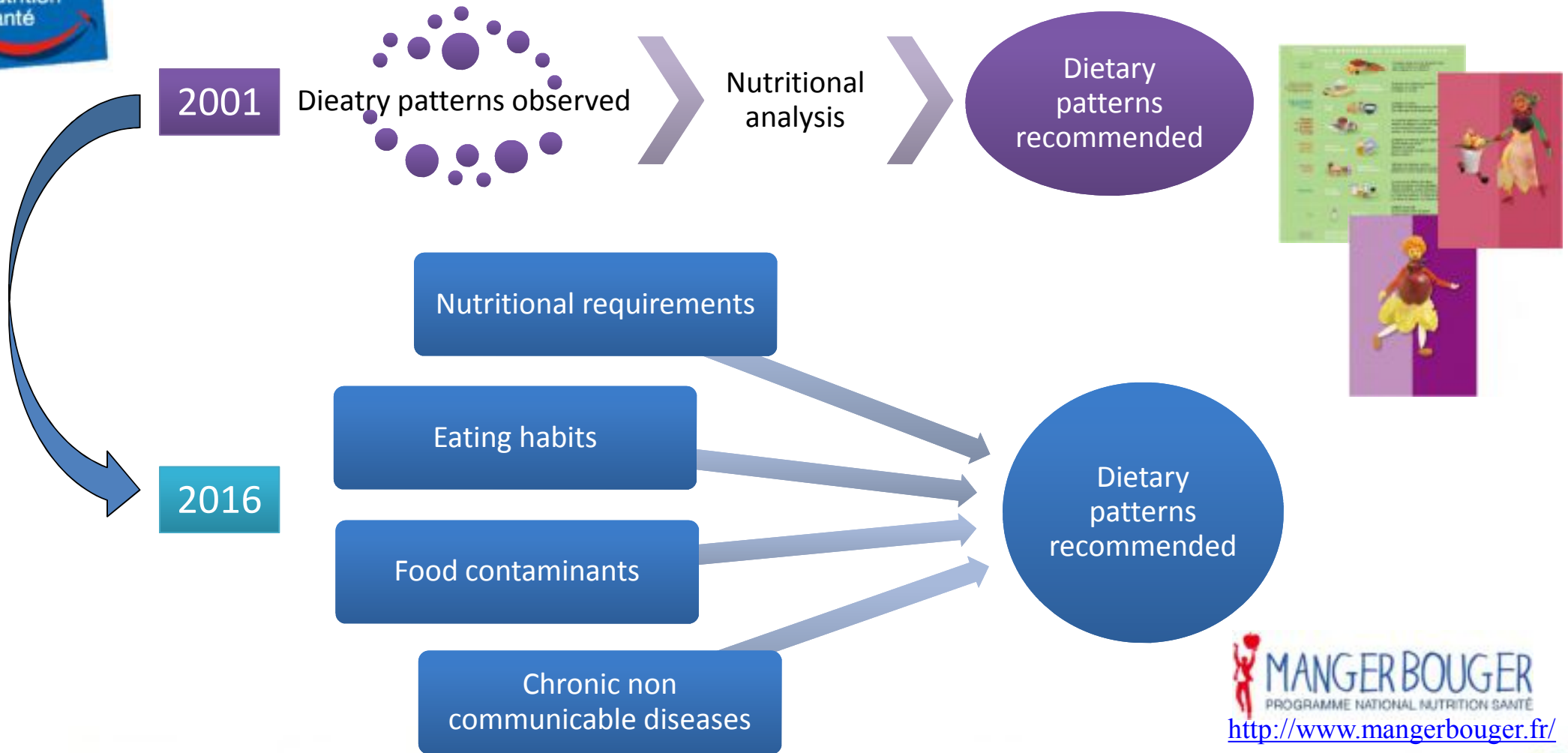


# **Risk-benefit approach in food and nutrition as basis for public health policy**

*Véronique Sirot, French Agency for Food, Environmental and Occupational Health & Safety (Anses)*

*Parma Summer School 2019  
“Risk-benefit in food safety and nutrition”  
Thursday 13 June 2019*

# French FBDG: Evolution of approaches



# Objective

To determine in what quantities food consumption would:

- Cover the **nutritional needs** (energy, macronutrients, vitamins, minerals...)
- Reduce the risk of **chronic non communicable diseases** (cancer, obesity, diabetes...)
- Limit the risk related to food **contaminants** (trace elements, environmental pollutants...)
- Take into account the **eating habits** and **food preferences**

Consumption diversity	34 nutrients of interest	98 contaminants of interest	Eating habits	Chronic non communicable diseases
<ul style="list-style-type: none"><li>• 1290 food products divided into 32 groups</li></ul>	<ul style="list-style-type: none"><li>• With a defined Population Reference Intake / Adequate Intake</li><li>• Composition data available</li></ul>	<ul style="list-style-type: none"><li>• With or without health-based guidance value</li><li>• Concentration data available</li></ul>	<ul style="list-style-type: none"><li>• Consumption levels (P5, mean, P95) in the population</li></ul>	<ul style="list-style-type: none"><li>• Relation between food group consumption and disease risk</li></ul>

→ Optimisation of consumption with a constraints system using linear programming of combined models (Simplex method)

# General model

Calculate the optimal consumption  $X_i$  for each food group  $i$ , that comply with 144 constraints:

- 41 nutritional constraints:

$$PRI \text{ or } AI \leq \sum_i X_i \cdot C_{i,nut} \leq USL$$

- 39 toxicological constraints:

$$\frac{\sum_i X_i \cdot C_{i,conta}}{BW} \leq \text{HBGV or P50}$$

- 3 constraints for « disease prevention »:

$X_i \leq \text{Max consumption epidemio}$   
(red meat, delicatessen meats, sugar-sweetened beverages)

- 61 constraints on eating habits:

$$P5 \leq X_i \leq P95$$

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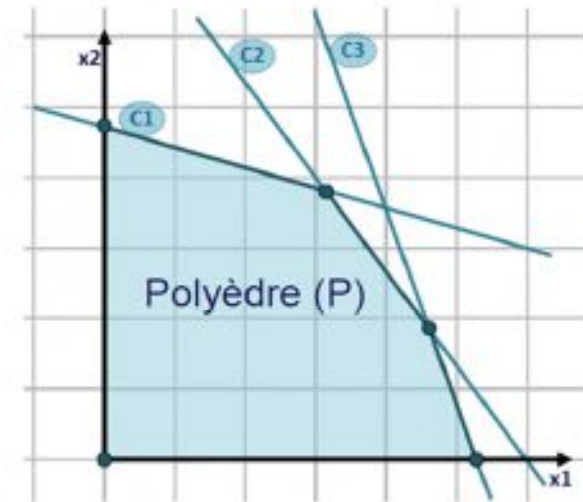
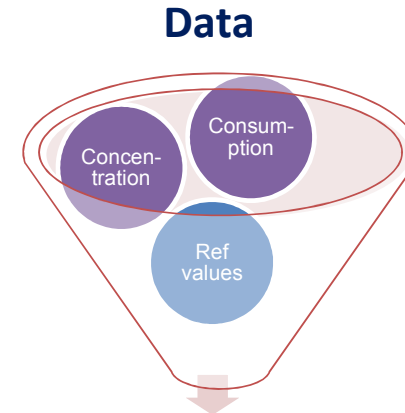
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# Optimisation criteria

## Disease prevention

- Minimize consumption of red meat, delicatessen meats, sugar-sweetened beverages
- Maximize consumption of fruits and vegetables, wholegrain bread and bread products, and other wholegrain starches

## Contaminant exposure

- Minimize the exposure to food contaminants

## Eating habits

- Minimize deviations from current consumptions

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## Eating habits

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## In case of no solution

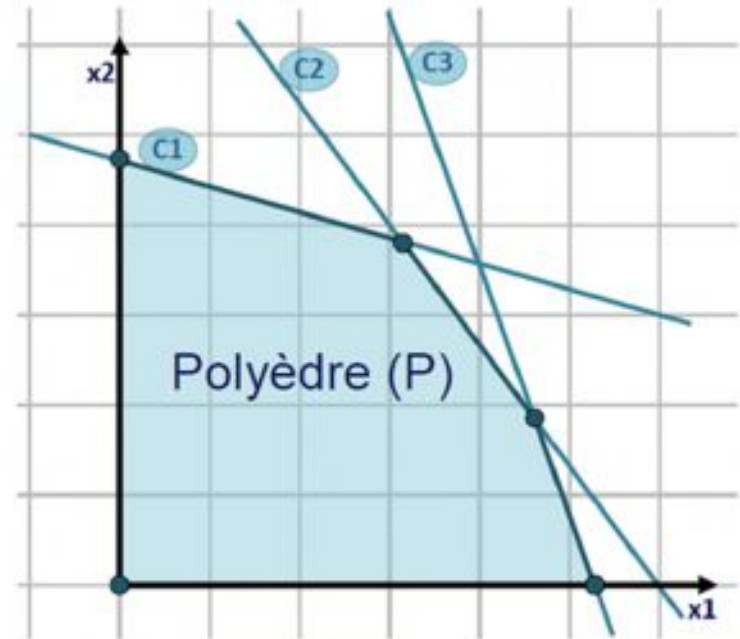
- Minimize the breach of the toxicological constraints
- Minimize the breach of the nutritional constraints

# Simplex theory

The algorithm helps determine a target value by successive iterations on one or more variables, taking into account the constraints imposed.

The algorithm searches for the only optimal solution in the domain of possible ones corresponding to a polyhedron with  $N$  dimensions defined by the constraints.

*Dantzig, 1963: « An optimal solution of a linear problem is necessary locted on a vertex of the polyhedron defined by the constraints. »*





## A compromise for vitamin D

- Except for vitamin D, the nutrient requirements of the population are covered, notably for Mg and vitamin C, for which the prevalence of inadequacy is high → the reference intakes are compatible
- The PRI for vitamin D is not possible to reach, taking into account the concentration of vitamin D but also the contamination levels of the main contributors, and the eating habits of the population → need for specific management measures for vitamin D such as:
  - Supplementation with medical control
  - Exposure to sunlight within the limits of skin cancer prevention recommendation
  - Food fortification as public health policy



# A compromise for contaminants

- Exposure levels generally lower than the HBGV and the current exposure (dioxins, PCBs, pesticides, PFAAs...)
- Except for CrVI (~110% current exposure) and lindane (~110% HBGV but exposure lowered)
- Exposure still associated with a health risk:
  - Men and women: inorganic arsenic, lead, acrylamide
  - Women only: nickel



→ Efforts to reduce the level of food contamination should be continued, particularly for those contaminants

# Results for adults – consumptions (g/day)

Food group	Men	Women	Food group	Men	Women
Vegetables	285	282	Milk	0	341
Fresh fruits	376	332	Plain fresh dairy products	122	36
Dried fruits	2.9	0.6	Sweetened fresh dairy prod.	0	47
Purees & cooked fruit	5.5	12	Sweetened dairy desserts	15	16
Oilseeds	8.6	4.6	Cheeses	81	24
Refined bread and bread prod.	0	0	Butter & reduced-fat butter	0	4.2
Plain wholegrain bread and bread products	70	60	Vegetable oils rich in ALA	21	16
Starch-based, sweet/fatty processed products	31	15	Vegetable oils poor in ALA & margarines	0.4	0
Starch-based, savoury/fatty processed products	16	20	Sauces, fresh creams & condiments	4.4	30
Other refined starches	14	14	Sweet or sweet & fatty products	28	55
Other plain wholegrain starches	243	179	Poultry	122	25
Pulses	50	32	Red meat	71	57
Drinking water	1002	806	Delicatessen meats	0	0
Sugar-sweetened beverages	0	0	Fatty fish	22	16
Fruit juice	263	28	Other fish & seafood	7	55
Salt	<0.1	<0.1	Eggs	46	12

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**Not a recommended diet**



# Food groups to be increased...

- Consumption of fruits and vegetables
- Fish twice a week, among which one portion of fish rich in EPA+DHA (salmon, herring...)
- Regularly consume legumes (lentils, chickpeas...)
- Favour plain wholegrain cereal products (bran bread, wholegrain rice & pasta...)
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## ... or decreased

- Delicatessen meats (ham, sausages...) < 25 g/day
- Meat excluding poultry (beef, pork...) < 500 g/week
- Less than 1 glass/day of sugar-sweetened beverages (sodas, fruit juices...)



# Advantages and limitations of the risk-benefit method

## Advantages

- Global and transposable method
- Allow to define objective and science-based dietary patterns
- Take into account many parameters
- Allow to identify public health issues

## Limitations

- Nutrient bioavailability in the food products are not taken into account
- Need a lot of data
- Uncertainties from databases and from the reference values used

## Perspectives

- Extend the method for different subgroups of the population and different dietary patterns (need a lot of data)
- Weight the criteria for the optimisation

# From Risks-Benefits results to food-based dietary guidelines



**Haut Conseil de la Santé Publique**

**AVIS**

relatif à la révision des recommandations pour les adultes de l'ANSES

Programme national nutrition santé 2017-2021

10 février 2017

Le Haut Conseil de la Santé Publique (HCSP) a été créé par la Direction générale de la santé par décret du 20 mars 2013 afin d'évaluer les risques et les bénéfices nutritionnels.

Le HCSP (2013) propose un modèle de recommandations nutritionnelles pour les adultes, basé sur le 23 mars 2013, visant à améliorer la santé publique en matière de nutrition et de recommandations pour la consommation d'aliments et la promotion d'un régime alimentaire sain.

En réponse à la demande du Directeur général de la Santé, le HCSP a pu se constituer les éléments suivants pour évaluer les risques nutritionnels de recommandations alternatives pour les adultes :

- Le rapport remis par l'ANSES (Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail) (2013) relatif au "Consommation des nutriments et micronutriments essentiels de l'ANSES (Nutrition) - Recommandations nutritionnelles pour les adultes"
- Les données issues des enquêtes représentatives de l'INSEE sur les habitudes de consommation alimentaire (ENNS) et les données de consommation alimentaire (ENNS) de l'ANSES (Nutrition) - Recommandations nutritionnelles pour les adultes (2013) et les données de l'ANSES (Nutrition) - Recommandations nutritionnelles pour les adultes (2013)
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**French Agency for Food Safety (ANSES)**

- Science-based optimal diets
- epidemiology
- data

**High Council of Public Health (HCSP)**

- consistency
- sustainability
- environmental impact

**Santé publique France (SPF)**

- knowledge, beliefs and population behavior
- understandability & acceptability



## General recommendations

- *Enjoy eating: opt for variety, take the time to eat and savour*
- *When possible, favour the « home made »*
- *Be careful of quantity and portion size you eat*
- *Well eating is also take into account environment by favouring local production, seasonal products, and if possible, organic foods*



# Increase fish consumption



Twice a week, among which one portion of fish rich in EPA+DHA

- *It is recommended to eat fish twice a week, including fatty fish (sardines, mackerel, herring, salmon) because fatty fish are rich in omega 3*
- *A large selection of fish is available. They can be consumed in all forms: fresh, frozen or canned*
- *Fish has many nutritional qualities. But some fish may contain pollutants, so it is recommended to vary the species*

# Decrease sugary drinks...

## ... but also fatty, sweet, salted and ultra-processed foods



Less than 1 glass/day of sugar-sweetened beverages (sodas, fruit juices...)

*It is recommended to limit sugary drinks, fatty, sweet, salted and ultra-processed foods*

- *Water is the only drink recommended. Fruit juices, sugary drinks and sodas, even light drinks, so-called "energizing" drinks should be limited as much as possible; in any case, not more than one drink per day*
- *Sugary breakfast cereals, cakes, chocolate, [...] and some commercially prepared meals often contain a lot of sugar, fat or salt. In addition to being fat, sweet or salty, these products are often ultra-processed, that is, they contain many additives (colours, preservatives, flavours...). The exact impact on human health is not yet known. As a precaution, choose foods without additives or with the shortest list of additives. Whenever possible, opt for home-made products using fresh, unprepared canned or frozen foods such as plain vegetables or natural fish fillets.*

# Conclusions

- The approach developed is **global** and integrates both the **benefits and risks** linked to food consumption
- The use of a mathematical algorithm makes it possible to integrate many parameters and not to limit to observed dietary patterns, in a search of **objectivity**
- Public health policies need an integrative approach combining scientific data, but also social, environmental or economical aspects
- In the future, the tool could evolve and incorporate other interesting criteria such as the environmental impact



Thank you for your attention

<https://www.anses.fr/en/system/files/NUT2012SA0103Ra-1EN.pdf>